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THE INSTITUTE OF PETROLEUM

REVIEW

June 1959

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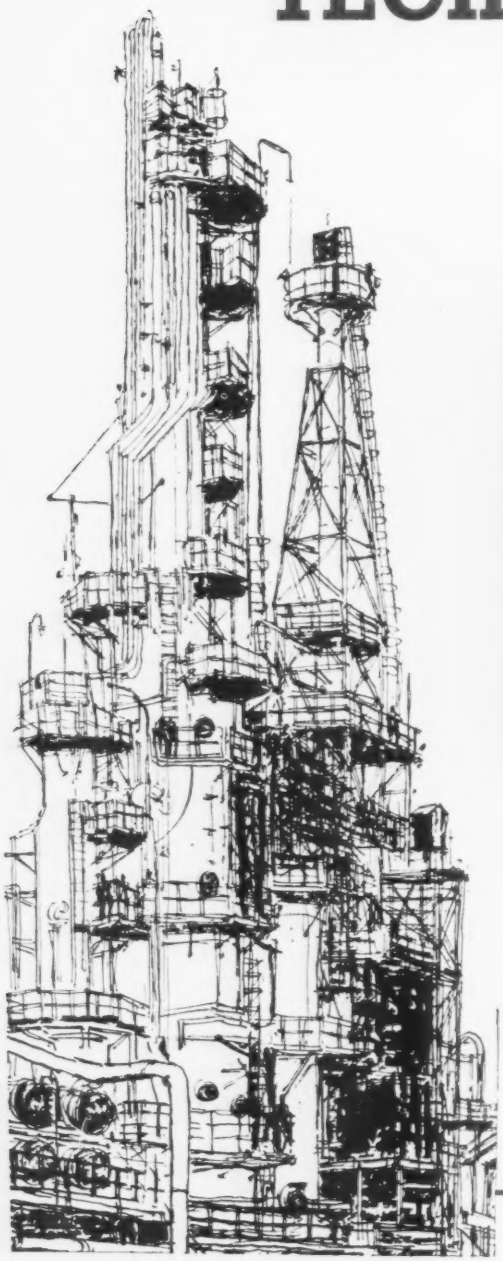

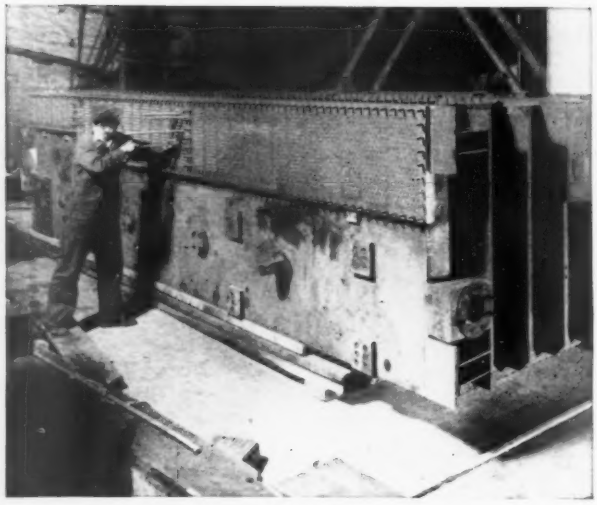

A 50,000 gal. day evaporator for a refinery under construction by Procon (Great Britain) for Anglo Ecuadorian Oilfields, Ltd., being tubed with SERCKALBRA.
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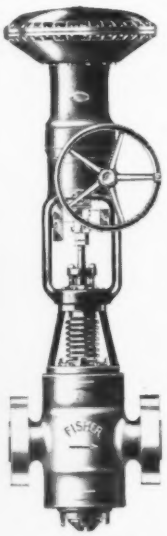

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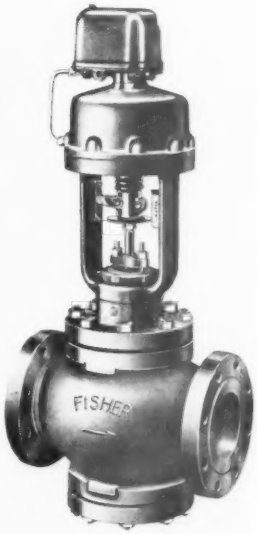

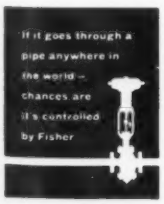

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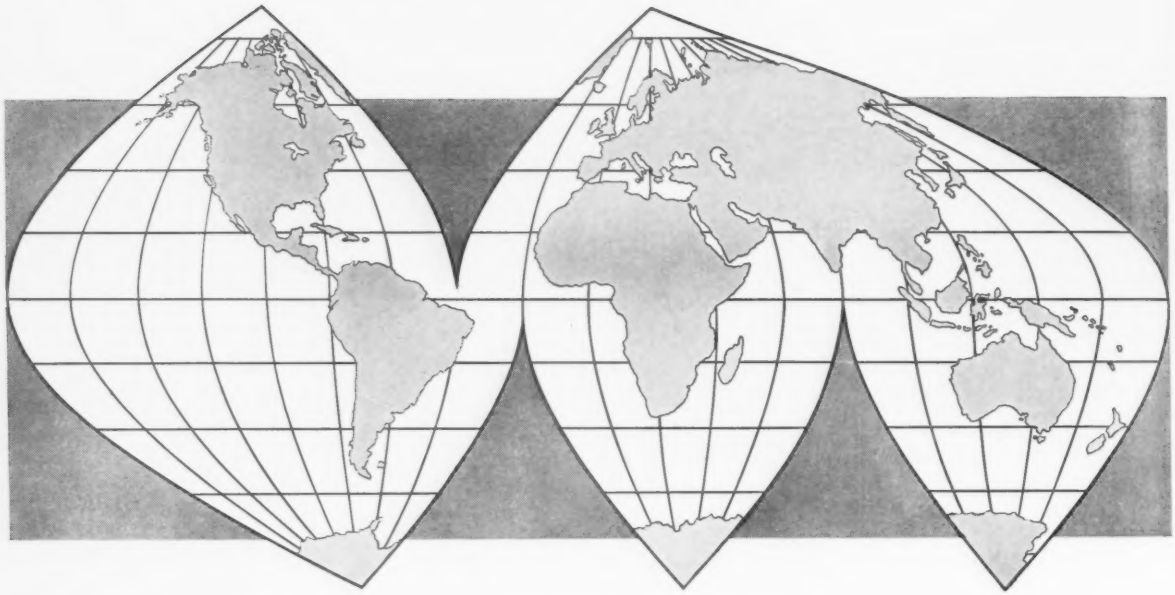

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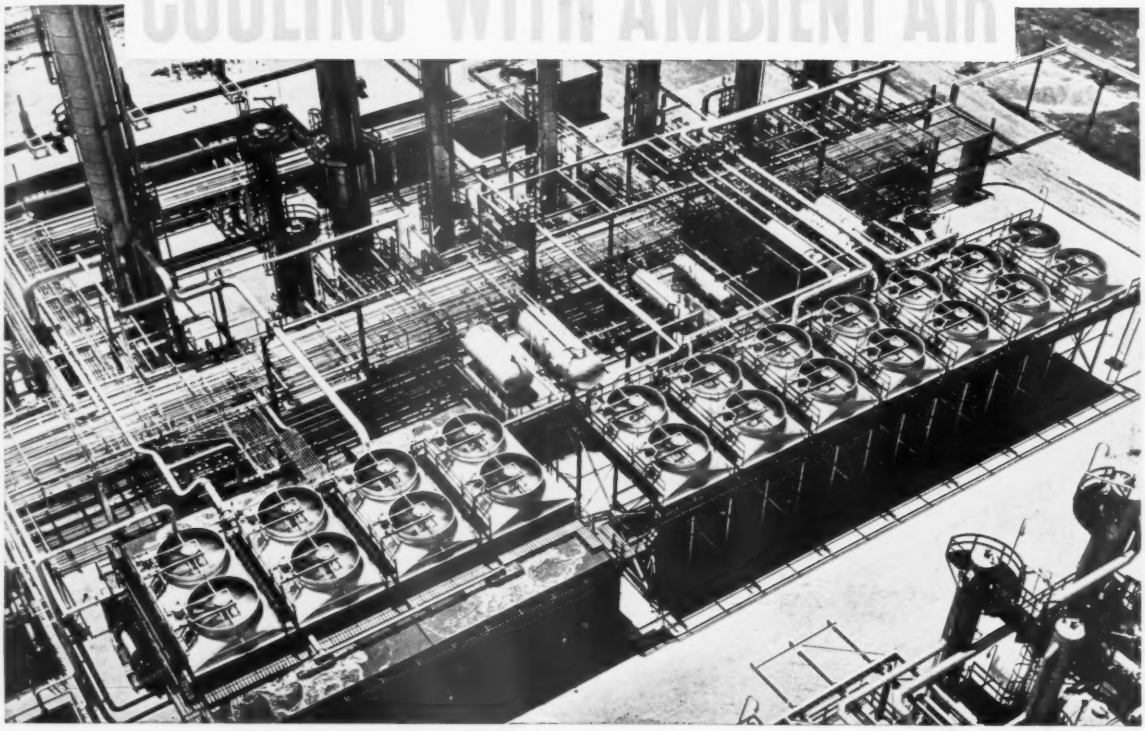

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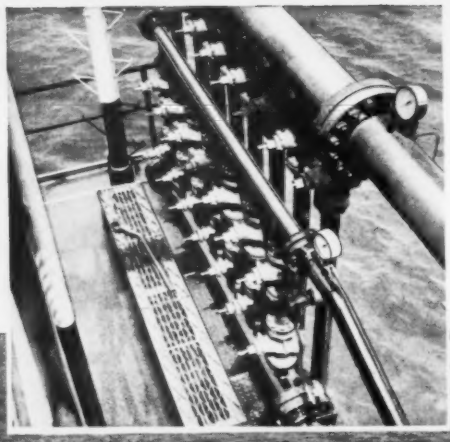

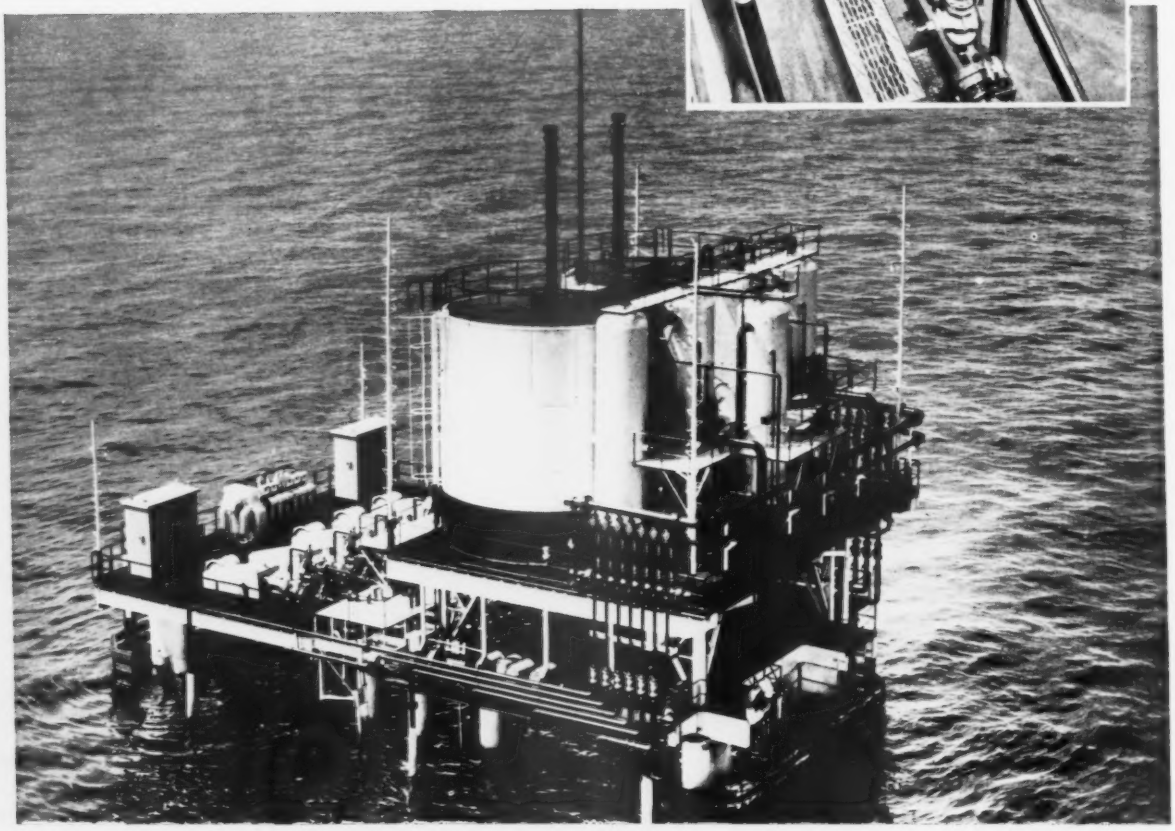

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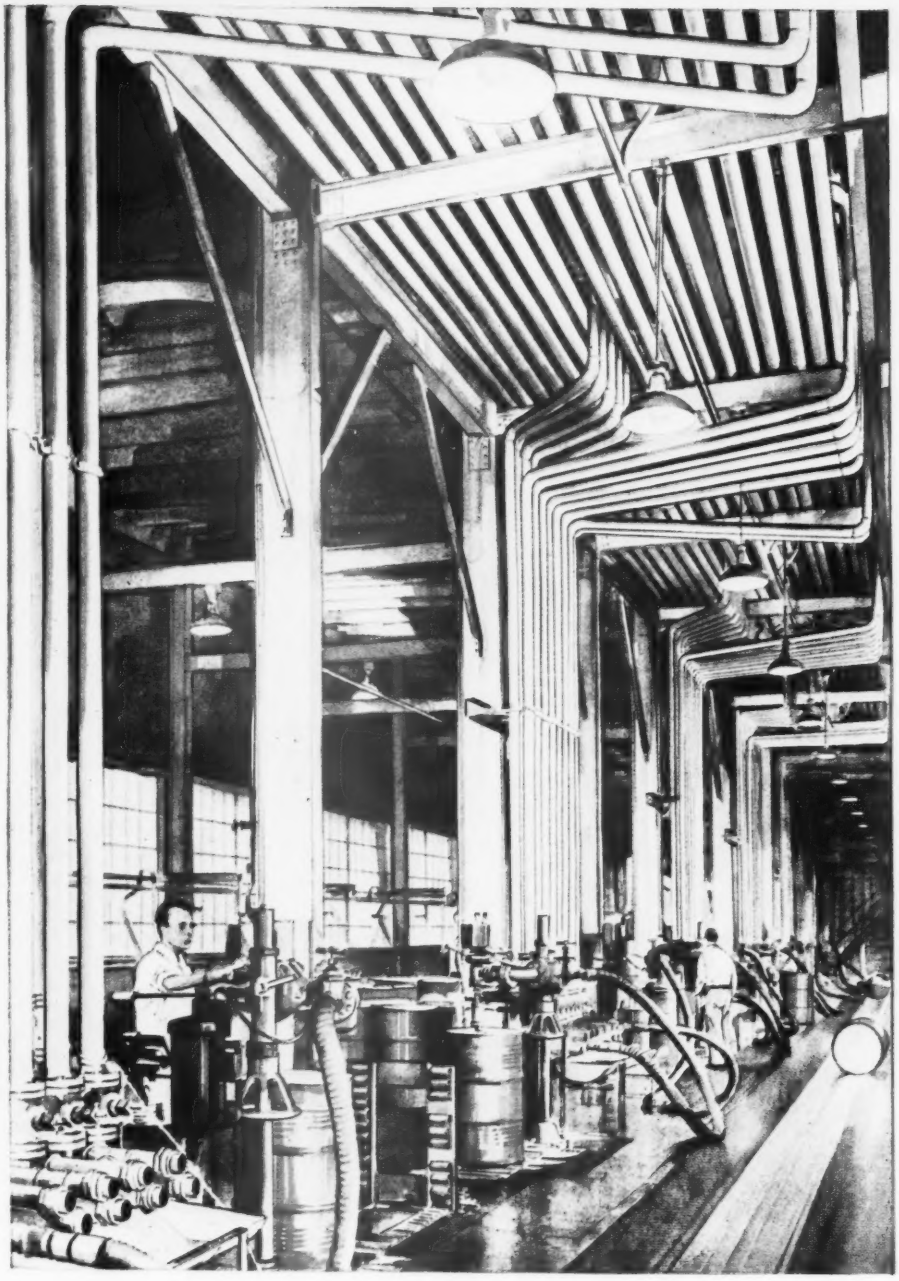

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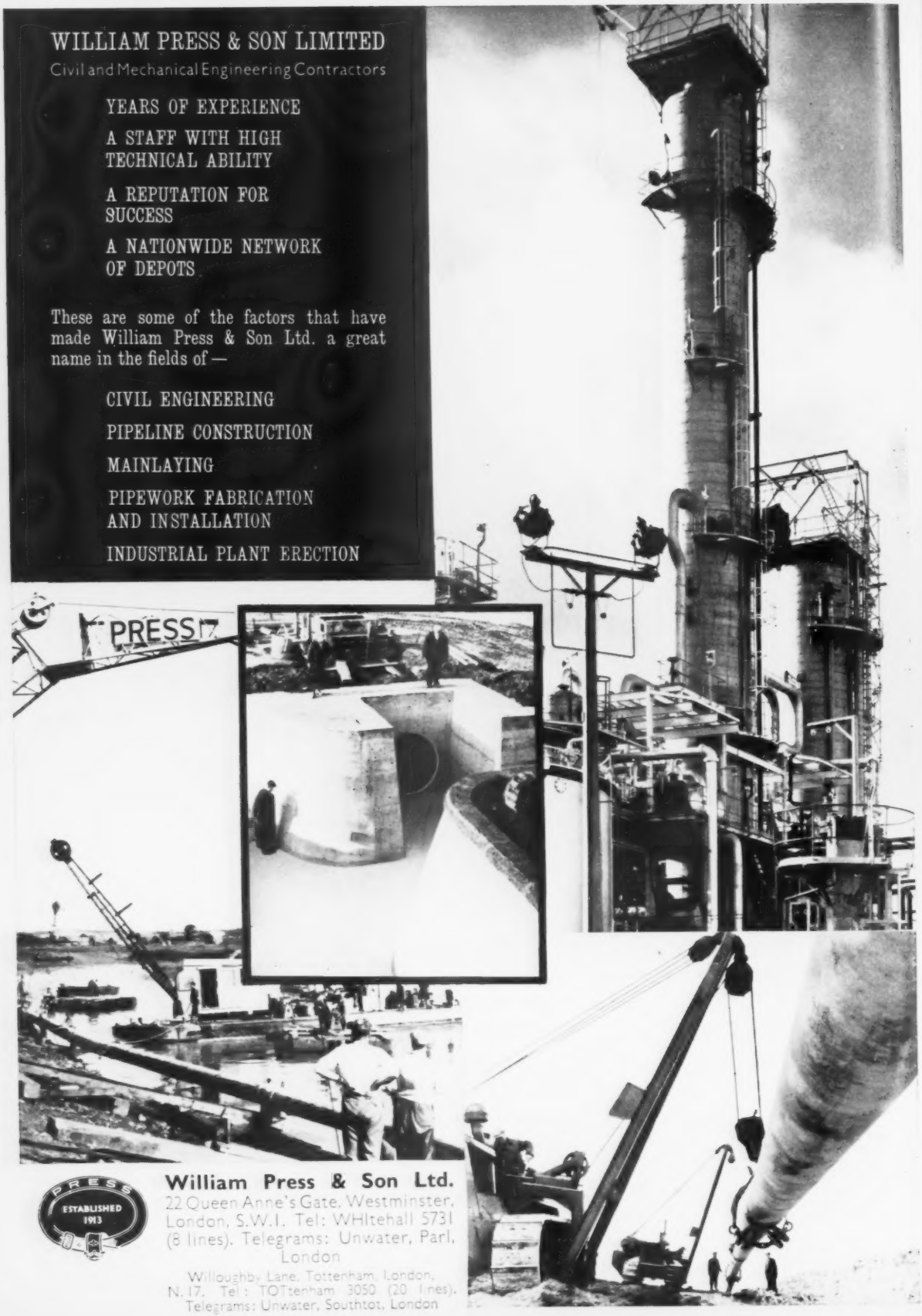

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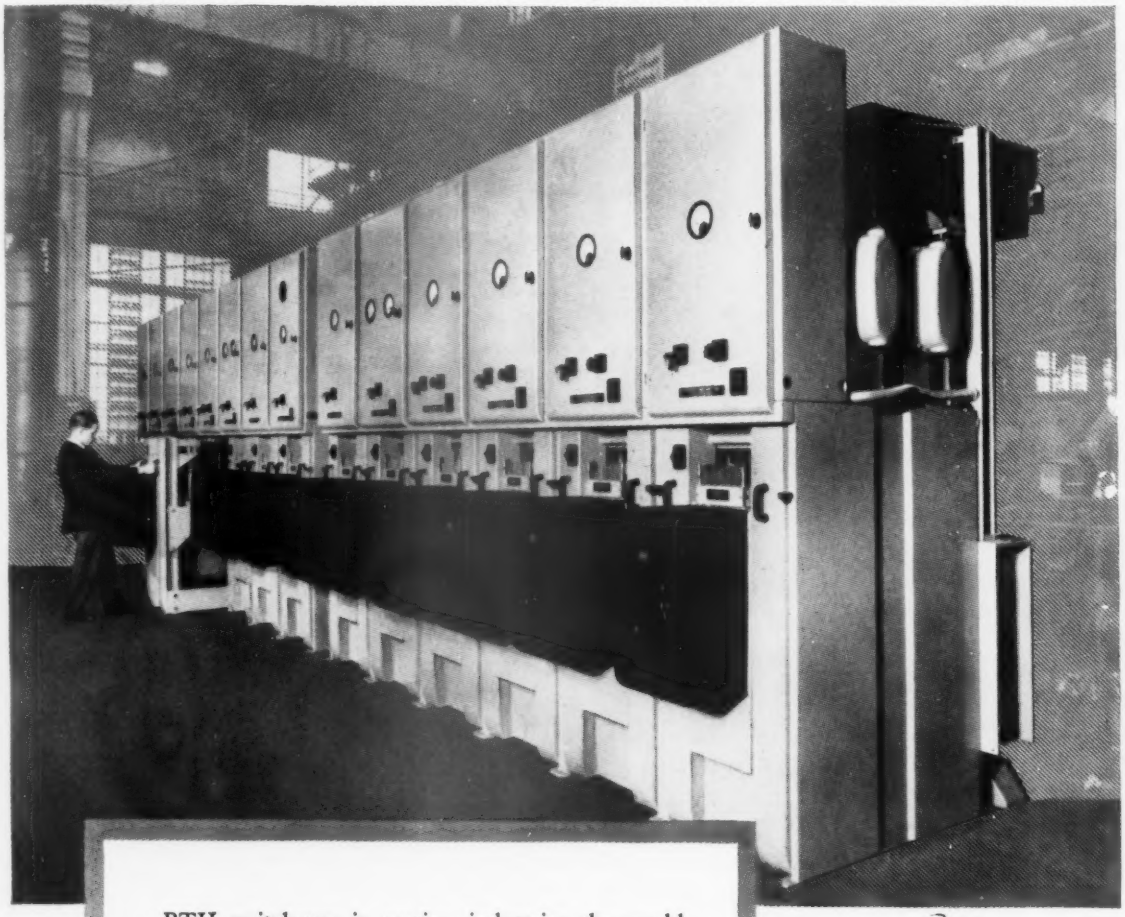

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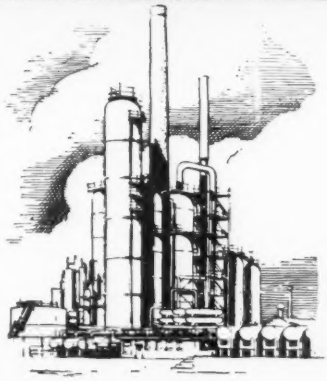

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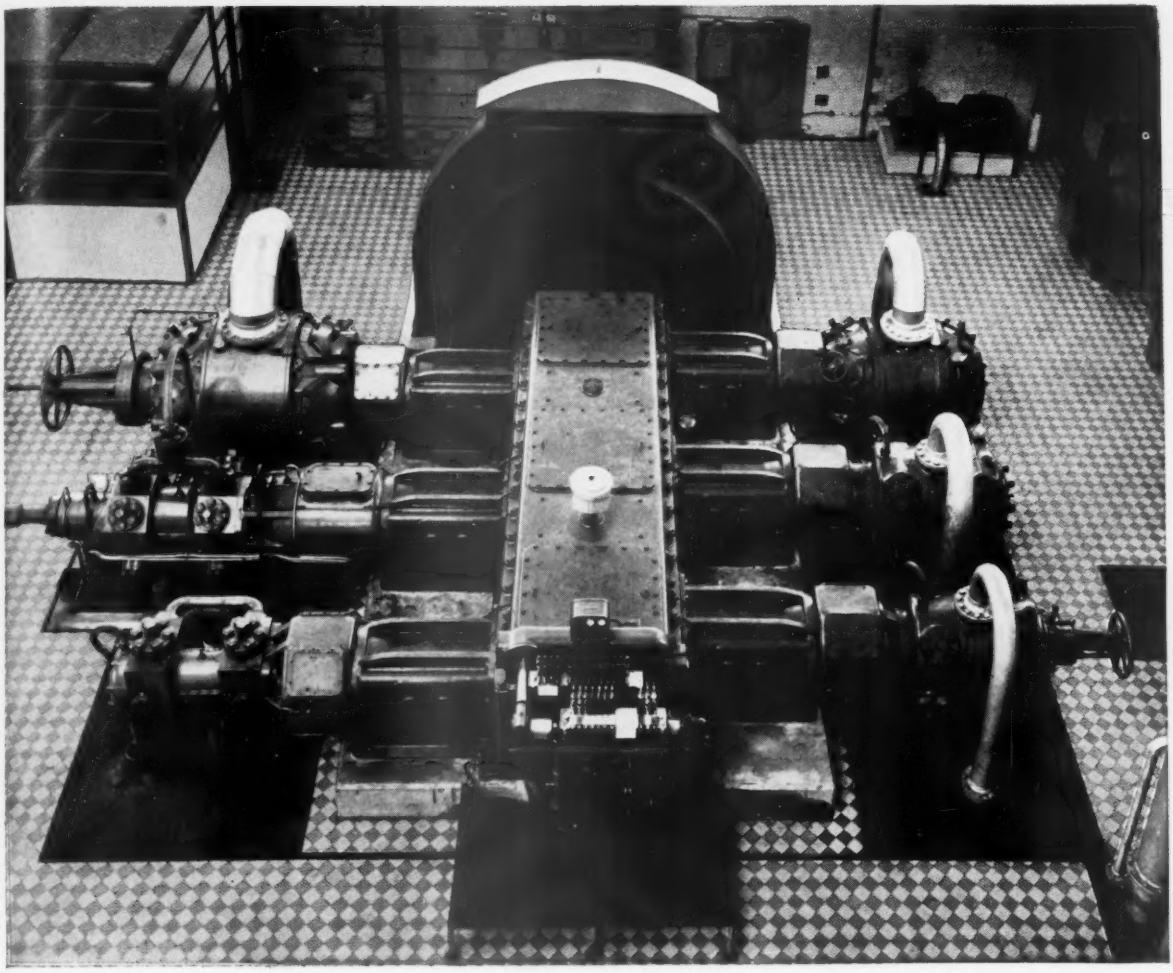

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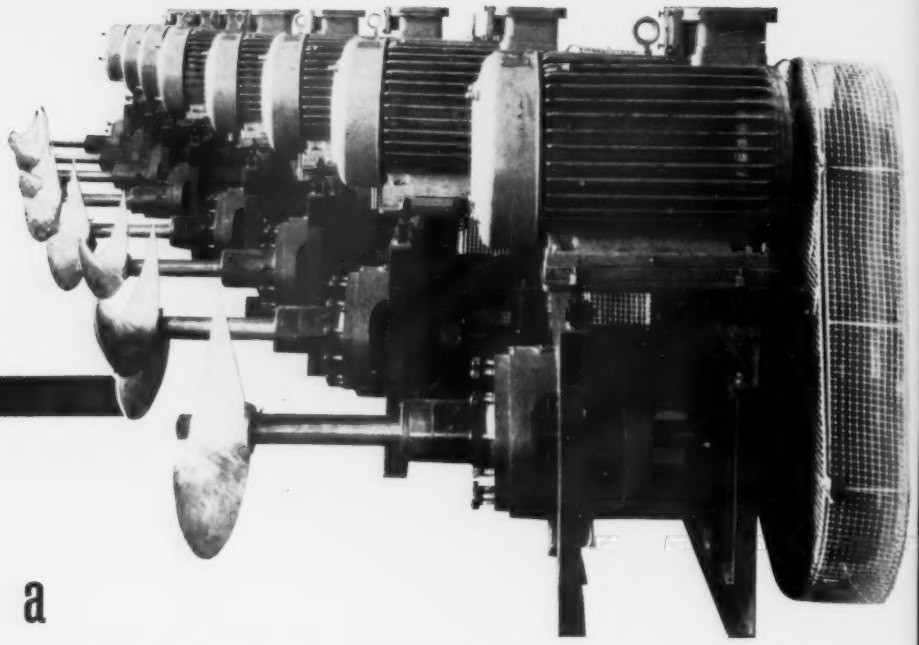

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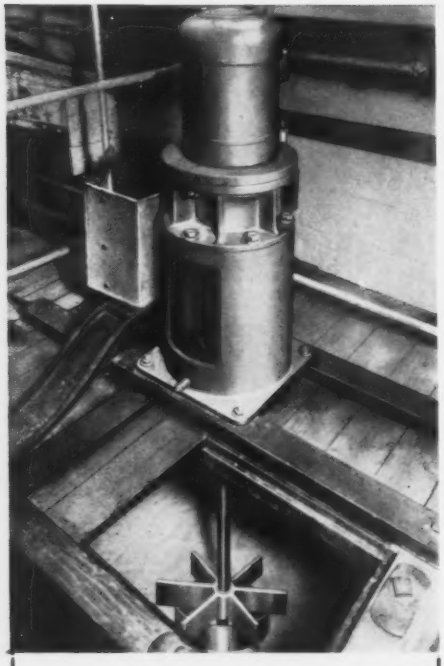

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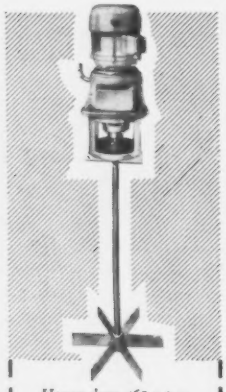

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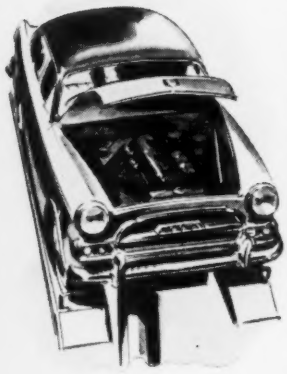

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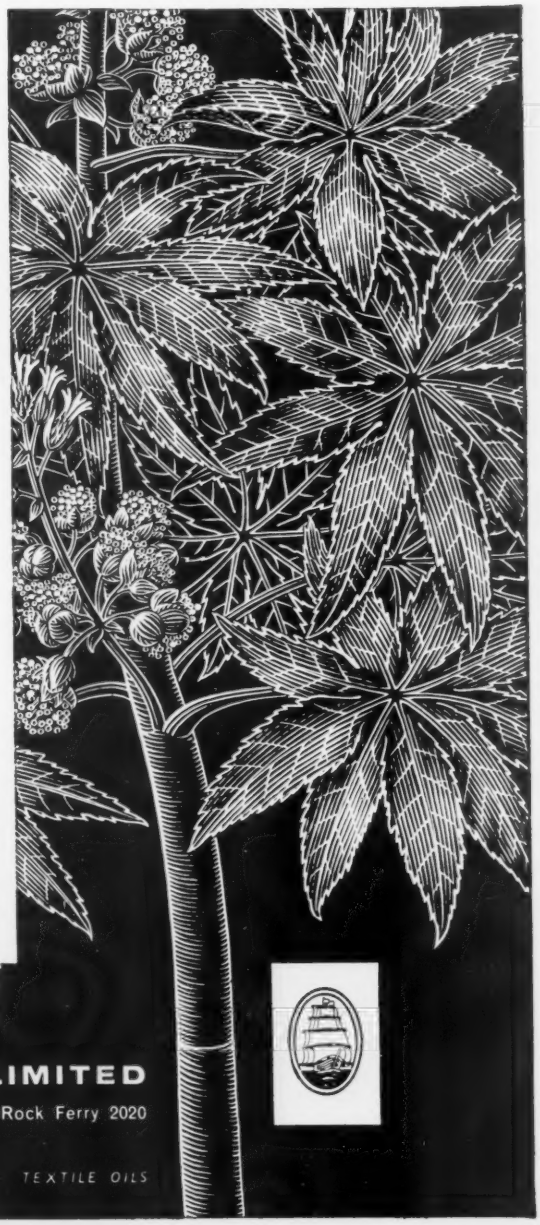

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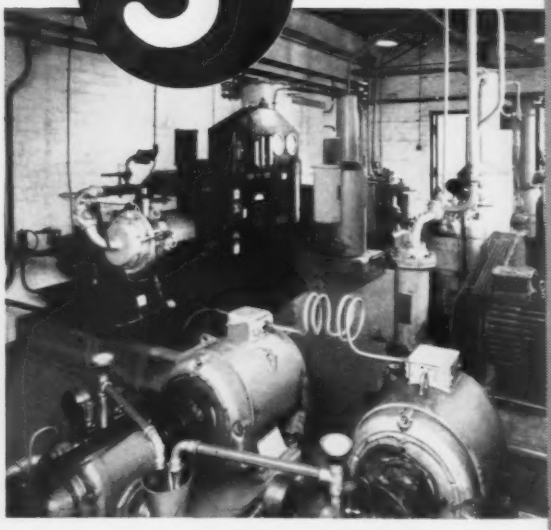

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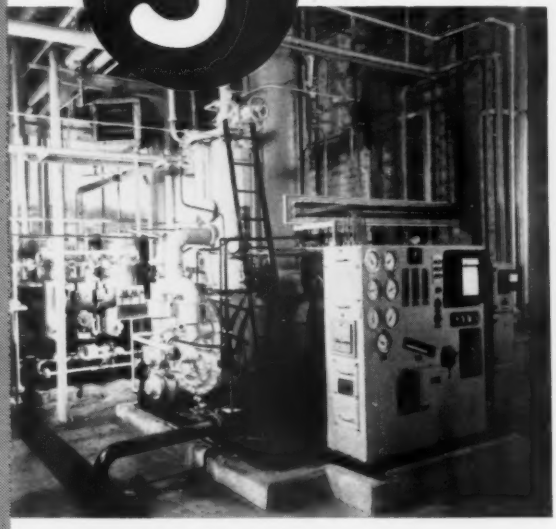

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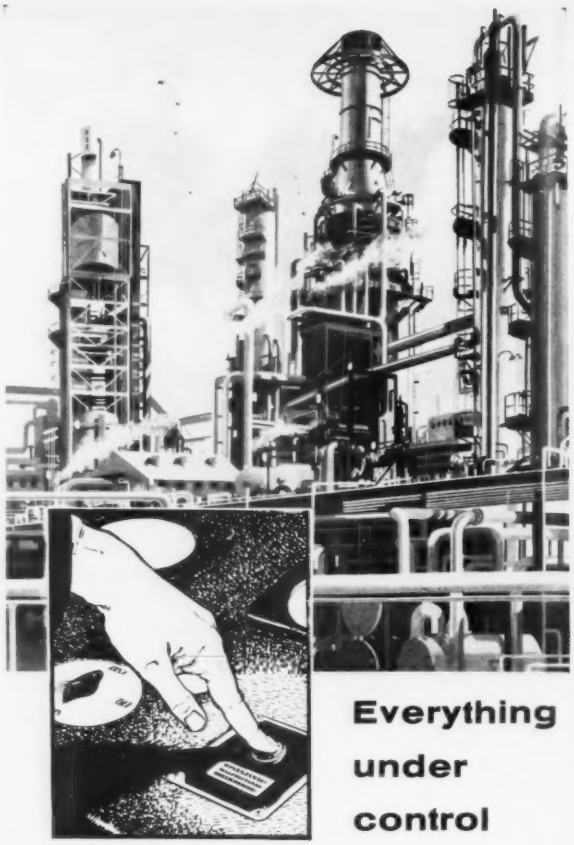

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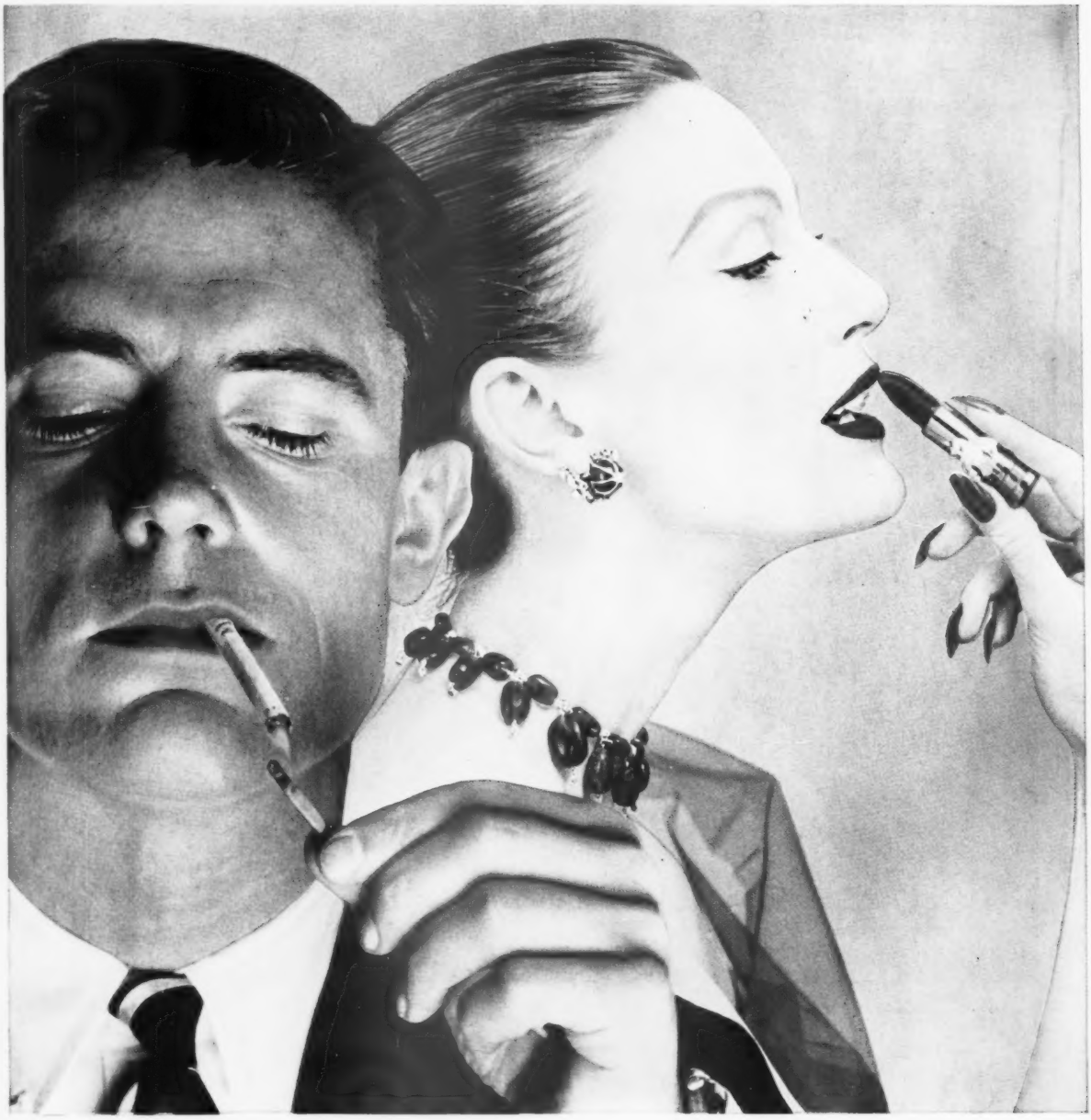

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Volume 13, No. 150 June 1959

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*1958 and its Implications for the Oil Industry**

By P. H. FRANKEL†

It is intended, rather than recounting facts and figures of 1958, to deal with a few of the main problems which were significant in the course of that year and which will remain so for some time to come. These will be as follows:

1. Was 1958 consumption of petroleum products in line with forward demand estimates in the U.K., in Europe, and in other parts of the world? What conclusions can be drawn from the 1958 developments regarding the relationship of oil to coal and other sources of energy in the near future?

2. How has the set-up in respect of international supply developed in 1958, and what are the repercussions of the advent of newcomers on the one hand and of the increasing rigidity of the U.S. import policy on the other?

3. 1958 has seen further steps towards the establishing on the Continent of Europe of a network of land-locked refineries fed by long-distance pipelines. A review of current policies for the location of refineries will show up some significant trends.

1. Consumption of Petroleum Products

The year 1958 has been beset by the results of the temporary trade recession in the U.S.A. and elsewhere. Consequently, for the first time since the war, energy consumption, for instance in the OEEC area, has gone down, albeit by an amount of only 1 per cent. Preliminary figures are shown in Table I. These developments give rise to two main comments:—

(a) The lack of progress in 1958 accentuates the fact that overall energy consumption in Europe has been increasing during the last three years at a considerably slower rate than was anticipated by the experts. During the period of the main post-war growth from 1950–1955, energy demanded in Europe rose at an average rate of 4½ per cent per annum. The Hartley Committee in its report *Europe's Growing Needs of Energy—How Can They be Met?* forecast in 1956 an increase in energy of 3½ per cent per annum for the period 1956–1960. The actual increase during 1955–1958 has been 1½ per cent per annum. It is, therefore, clear that it is very unlikely that the targets shown for 1960 in Table I will in fact be achieved.

(b) From our industry's point of view the most significant lesson to be drawn from Table I is that petroleum products and natural gas were in fact very buoyant, the results of the recession being borne entirely by coal. This shows up a peculiar relationship between the two sources of energy: whereas in countries with a substantial indigenous coal production, *e.g.* the U.K. and Western Germany, politically *oil* is the "expendable" source of energy, the opposite appears to be the case as far as consumer demand is concerned, *i.e.* when there is a reduction in total demand it is coal which is the first to suffer.

TABLE I
OEEC AREA
INLAND CONSUMPTION OF PRIMARY ENERGY 1955–60
(million tons coal equivalent)

	1955	1957	1958 (b)	*Approx.* % *inc. or dec.* 1958 *on* 1957	1960 (c)
Hard coal	504	516	475	− 8	540
Brown coal	30	32	32	—	35
Natural gas	6	9	10	+11	10
Petroleum products (a)	117	139	162	+16½	180
Hydro-electricity ...	77	84	91	+ 8½	103
Total	734	780	770	− 1	868

Conversion factors:

	Hard coal
1 ton brown coal	= 0·28 tons
1 ton petroleum (energy) products	= 1·5 tons
1000 m³ natural gas	= 1·33 tons
1 million kWh electricity	= 0·55 tons

(a) energy products only.

(b) part-estimated.

(c) Forecast made in OEEC Report "Europe's Growing Needs of Energy—How Can They be Met?" adjusted to same basis as 1955–58.

*Presented to the IP Economics and Operations Group on 9 April 1959.

†Petroleum Economics Ltd.

In Table II the 1958 demand for petroleum products, as compared with 1956 and 1957 respectively, is shown for the OEEC area, and these figures demonstrate the substantial progress made by oil in these countries even in 1958. Table II shows that, as distinct from overall energy demand, the consumption of petroleum products in Europe has now fully recovered from the temporary Suez setback, and is now developing in line with the forecasts made by the OEEC Oil Committee in 1956. An average increase in consumption of about 8 per cent per annum in both 1959 and 1960 would be required to reach the consumption expected by that Committee in 1960. Given normal economic development this is not an unreasonable assumption to make.

TABLE II
OEEC AREA—PETROLEUM PRODUCTS CONSUMPTION
(million metric tons)

	1955	1956	1957	1958	1960*
Inland	87	101	102	118½	137
Bunkers	13	14	13	13½	16
Total	100	115	115	132	153

*Estimated by the OEEC Oil Committee in its report "Oil—the Outlook for Europe", 1956.

Obviously there is, in coal-producing countries such as the U.K., an overriding need to maintain a certain level of output of the coal industry, partly for reasons of national security, partly for social reasons. On the other hand there is the economic fact that marginal coal production in this country and in some others is obtained at comparatively high cost, whereas in the present state of potential oil supply additional oil would tend to get cheaper, the more use there is for it (a point made more explicitly later in this paper). It is also necessary, when the relationship of oil to the coal industry is defined, to distinguish between the immediate repercussions of a drop in demand for coal (unemployment of miners) and the longer-term effect which would express itself in the investment programme of the coal industry. If such coal industry programme is, as it is apparently now as far as the National Coal Board is concerned, designed for economical operation rather than for maximum output,† a falling-back of coal in the energy balance may be beneficial all round. It is this idea which was apparently in Mr Snow's mind when he read his paper "Looking Ahead" to the Institute of Petroleum on the 4 March, where he said "Gradual and progressive development should in fact be of assistance to the coal industry in dealing over a period with its own fringe problems of excessively high cost of marginal production".

If however oil can continue to have an extensive programme for residual fuel oil it remains to be seen whether another statement which Mr Snow made in the same paper will continue to hold good entirely. He suggested that, at least as far as the U.K. is concerned: "The use of oil for steam raising for electricity generation in a country with indigenous coal supplies is an unattractive business for oil. It means the use of oil in circumstances in which a major part of its inherent advantages are not turned to account." The relative competitive positions of coal and oil are difficult to define by the end-use only, since geographical elements play such a great rôle. Also it is doubtful whether there is an essential difference between the use of fuel for generation of electricity and that in many other large-scale works producing their own power. Indeed, the fact that big refineries are being built in the Ruhr, the very centre of European coal production, appears to prove this point.

It is to be expected that the 1958 position, where the energy gap was apparently transformed into an energy bulge, will not recur in the same form. Oil as a source of general energy is likely to continue buoyant on the strength of its technical and economic advantages resulting in an almost irresistible consumer appeal. It is to be hoped that by general increase of demand and possibly by reorientation of the coal industry a situation in which remedial action, such as special fuel oil taxes, may be taken will not arise. Such protective taxation of a competitor of coal—or rather of the marginal high-cost coal—would have an almost punitive character. It would make for some time to come nonsense of any endeavour to strive for low-cost energy in Britain. Worse still it would remove the only telling argument against being overcharged by the countries where the crude oil is produced: how can one warn them of the danger of pressing too hard for yet higher benefits per barrel of oil if the only reaction to lower oil prices is to undo it by a form of taxation designed to nullify the results of lower prices?

To look beyond Europe, consumption of petroleum products in the "Free World" is shown in Table III for the years 1956–58. This table shows clearly that progress in the Eastern Hemisphere has been fully maintained—it was spectacular in Western Europe—and that the comparative lag world-wide was entirely due to the progress made in the Western Hemisphere, (especially in the U.S.A.), being small. If current estimates of 1959 demand in the U.S.A., which show a 5 per cent increase as compared with 1958, are to the point, the influence on the world figures will be substantial, inasmuch as the increases in the Eastern Hemisphere should not be smaller than they were last year.

2. International Oil Supplies

Two important events of 1958 which ostensibly worked in opposite directions were in fact pulling in the same direction. The two events were: the advent of actual and potential newcomers to the rank of suppliers of Venezuelan or Eastern Hemisphere crude oil, and the imposition of official (mandatory) oil import restrictions in the U.S.A. The former could have been expected to lead to a more wide-open competition, whereas the latter is a portent of more direct governmental influence on the flow of oil in international trade. As will be seen, however, the advent of newcomers itself may also strengthen the tendency towards governmental control of oil.

The problem of the control of imports to the U.S.A. is not a new one. It dates from the time when it turned out that the cost of producing oil elsewhere, *e.g.* Venezuela and the Middle East, was very much lower than it was for most oil within the U.S.A. The decision to move only comparatively slowly towards increased imports was taken in the first instance by American oil companies with foreign production, who however, had also a substantial stake in the development of domestic U.S. crude and a vested interest in the stability of the U.S. domestic market. For several years after the war

†Cf. *The Times* of 11 December 1958—"Changing Demand for Coal"—by Sir James Bowman, Chairman of the National Coal Board:—

> "The policy of going all out for the last ton served the nation's purpose at the time. We are well aware that it is no longer necessary."

TABLE III

FREE WORLD
PETROLEUM PRODUCTS CONSUMPTION 1956, 1957, AND 1958
(million metric tons)

	1956	1957	1958	% *inc. or dec.* 1958 *on* 1957	% *inc. or dec.* 1958 *on* 1956
W. Hemisphere					
U.S.A.	395	396	406	+ 2·5	+ 2·8
S. America	52	55	57	+ 3·6	+ 9·6
Other W. Hemisphere	44	47	49	+ 4·3	+ 11·4
Total W. Hemisphere	491	498	512	+ 2·8	+ 4·3
E. Hemisphere ...					
W. Europe	120	122	140	+14·8	+16·7
Asia	64	72	76	+ 5·6	+18·8
Africa	20	21	20	− 4·8	—
Total E. Hemisphere	204	215	236	+ 9·8	+15·7
TOTAL FREE WORLD	695	713	748	+ 4·9	+ 7·6

the factor determining the volume of imports was what was then called industrial statesmanship—a policy adopted by the leading importers. It was then said that "imports should supplement, not supplant, domestic oil production". However, as time went on, more refiners, especially those who had not enough of their own crude oil and were substantial buyers of U.S. crude, were tempted to turn increasingly towards imported crude, and non-American foreign producers wished to sell to these refineries.

With the cost of foreign crude being further reduced by unprecedentedly low ocean tanker freights, industrial statesmanship was not sufficient to stem the rising tide of imports, and the U.S. government—first under the guise of a so-called voluntary scheme, but more lately by mandatory regulations—put a ceiling on imports of crude oil and now also on petroleum products.

This example given by the U.S. government, which otherwise tends to propagate the idea of trade liberalization, may have substantial repercussions inasmuch as other governments may take a leaf out of the Americans' book. This may lead to import controls in certain consumer countries and, equally important, to an endeavour to give certain governments a voice in the volume and the direction of exports of crude oil and products. Indeed, the U.S. government seems to feel that such governmental influence could be expected, as can be seen from the following statement made recently by Mr Hoegh, Director, Civil and Defence Mobilization, in Washington:—

> "It is apparent to me that in the current world oversupply situation, excessive quantities of low-priced oils from offshore sources are seeking a U.S. market. In such a situation, without control of production in relation to demand by the countries of origin, it is to be expected that there would be substantial economic incentives to increase imports into the U.S."

Washington appears to consider it most surprising that other governments do not take it upon themselves to regulate the flow of oil across their borders, a hint that might be taken.

Hitherto it was the few international companies who determined the direction and the magnitude of oil supplies from country to country, but the newcomers whose operation will not be guided comparatively smoothly by their own distribution facilities will, by sharpening the ostensible difficulties, accelerate the existing tendencies of governments to endeavour to establish an equilibrium of supply and demand. We have heard such argument on several occasions from Venezuela, and others may tend to follow. For all these reasons it appears that the portents are for an increasing incidence of governmental, *i.e.* national and inter-national influence on the structure of international oil.

3. Location of Refineries

During 1958 new facets have become noticeable in respect of the perennial problem of where to locate an oil refinery. The classical choice was to locate it either as near as possible to the source of crude oil, or as close as was practicable to the market for finished products. Until the last war the first-named type of refineries—resource orientated—was considered by the oil industry to be more economical, whereas since the war, for several reasons, the centre of gravity of the refining system has moved towards the consuming areas. The point which interests us in this context is that in 1958 great progress has been made towards developing a type of refinery in Europe which was hitherto hardly known, that is to say inland refineries at the end of large-diameter pipelines leading from suitably situated continental ports of entry.

In this connexion two features, which determine in all cases the location of a refining industry, have to be considered:—

First, the decision whether to build the refinery either at one of the two extreme points mentioned above, or at some point in between the two, is influenced by the relationship of the cost of transport for crude oil and for finished products respectively. The greater the difference, *i.e.* the cheaper it is to move crude oil as compared with the sum total of finished products, the more economic it will be to build the refineries away from the source and as near as possible to the centres of consumption. (In making the calculation, the fact has to be borne in mind that if products rather than crude are moved the volume is smaller, since the refining losses, and the utilization of some part of the yields as refinery fuel, have been incurred before freight costs have arisen.) In the comparatively recent past, two events have taken place which have cheapened crude oil transport and therefore increased its advantage as compared with the transport of products. One is the advent of very large tankers (up to 100,000 tons dw), which are more likely to be used for crude oil than for any one product. This is due to products having inevitably to be moved in rather smaller quantities at a time, plus the fact that storage problems have to be taken into account also, and because only a few ports' installations are suitable for the biggest tankers, whereas for products a greater number of ports have to be serviced. It is well-known that transport costs in the very

TABLE IV

TRANSPORT COSTS IN LARGER TANKERS
EXPRESSED AS PERCENTAGES OF THOSE IN A "T2"*

16,000 dwt (T2)	100
20,000 dwt	95
32,000 dwt	73
38,000 dwt	67
45,000 dwt	61
60,000 dwt	56
80,000 dwt	52
90,000 dwt	50

*Table taken from paper entitled "Current Economic Trends in Location and Size of Refineries in Europe" by P. H. Frankel and W. L. Newton, presented to the Fifth World Petroleum Congress in New York, June 1959.

large tankers are lower than in smaller ones, a relationship which is illustrated in Table IV.

The other feature is the possibility of using large-diameter pipelines to supply inland refineries, thus reducing the cost of transport for crude to an extent which only in very rare circumstances could be matched by a commensurate reduction of transport costs for finished products.

The construction of refineries inland, *i.e.* away from main deepsea ports, was not possible as long as there was practically no large-scale market for residual fuel oil except for the bunker business. Consequently, previously the nearest refineries could get to consuming areas in Europe was to the main ports, *e.g.* Hamburg, the Lower Seine, the Lower Rhône, Genoa, Venice, etc. Only since demand for residual fuel oil in many inland areas of the European countries became a reality were the main conditions for bringing refineries further forward towards certain consuming areas fulfilled. The first examples of such pipeline-based inland refineries were those in the Po Valley, *i.e.* Condor at Rho and SARPOM at Trecate, both fed by pipelines from the west coast of Italy. On a larger scale this is now being repeated in the area of the Lower and Upper Rhine, comprising several refineries in the Cologne area, whilst in 1958 several projects for refineries to be built in the Strasbourg–Karlsruhe area were formulated.

DISCUSSION

W. Jamieson (opening discussion): I should like to concentrate on two questions: first, do the American import restrictions mean that the U.S.A. will in fact reduce imports permanently, *i.e.* will they be able to meet future demand entirely or mainly from their own resources? Secondly, in respect of the newcomers to whose advent Dr Frankel referred, are they not the natural result of the quantitative development of the oil industry which means that there is a need to tap new sources of capital?

Dr Frankel: As to Mr Jamieson's first question, we must distinguish between the method of determining or controlling the flow of imports and the volume of these imports. I feel almost certain that in view of the big difference in cost between some non-U.S.A. oil and most of the American oil, there is little likelihood of imports becoming once more entirely free of governmental controls. On the other hand I do think that there will be the increasing need for imports to which Mr Jamieson referred, and that the formula by which the quantities which can be imported is arrived at will be changed from time to time. I should take the opportunity of pointing out that there has been for many years a *de facto* "control" of imports to the U.S.A. which was based on the "self-denial", as it were, of the importers. This semi-automatic system became, however, ineffective because as time went on too many people on both sides *i.e.* refiners in the U.S.A. and foreign suppliers on the other side, have "got into the act". Some of them were less interested than the original importers in what was then called industrial statesmanship. Regarding the impact of newcomers, I agree with Mr Jamieson that as we live in a dynamic world and in a growing industry it is natural that new forces come into play all the time, but just as in the U.S.A. the fact that there were many people involved resulted in the call for governmental rather than genuinely voluntary restrictions, so it could happen that the increase in competition elsewhere, and the change of the character of the competition brought about by the bigger number of participants, will lead not to freer markets but eventually to control by a number of authorities.

For instance, the Venezuelans now suggest that there should be a rational method of apportioning production to bring it in line with demand. This is exactly what the Texas Railroad Commission does, for a substantial part of the United States production. And indeed, having had this governmental control of domestic production, one cannot foresee how the American oil economy could remain on an even keel without it. This is one of the reasons why I think that mandatory controls, once established, have a great tendency to stick.

G. Chandler: Does your analysis of the coal-oil relationship deal mainly with the short-term, or the more remote long-term, aspect of the problem?

Dr Frankel: The problems involved in "competition" between coal and oil are both immediate and long-term. In the short run I agree with what Mr Snow said here a few weeks ago, that it is unacceptable from the political and the human angle to cause any widespread unemployment among the miners. Therefore we cannot do what apparently can be done in the U.S.S.R., where the new Seven-Year Plan involves a curtailment of coal in favour of oil, and especially natural gas. But in the Soviet system you can do what you cannot do in the West, *i.e.* force manpower rapidly from occupations which have become uneconomic into new ones. The position is different when it comes to making investment decisions, and it is there, as I said earlier on, that we should look very closely into the policies now applied in the U.K.

Mr Priddle: Dr Frankel mentioned Mr Snow's advice against relying on oil for thermal power stations. Is it not the case that there are large areas in the world where oil as a fuel has competitive advantages over nuclear power or coal, and appears as an attractive fuel to public utilities?

Dr Frankel: First, Mr Snow talked mainly about U.K. conditions. Furthermore, I quoted Mr Snow's opinion because his views obviously command universal respect. But I do not altogether agree with him. There is the question of location of the power plant. There are, even in the U.K., points such as Southampton Water where oil coming directly from a big refinery must be more economic than coal coming a long way. Also I do not think that there is a fundamental difference in the use of fuel between power stations and other large-scale industrial sectors.

Mr Bennett: As Dr Frankel has referred to the Ruhr, could he say something more about the economics of refining there, also with reference to the chemical industry, the uses for gas, etc?

Dr Frankel: If the question of where to locate a refinery had been asked more than ten years ago, the Ruhr would have been one of the least likely areas in Europe. It may be that some of the projects there have been too ambitious, and the socalled "second stage" of those refinery programmes might not be realized in the near future. But it must be remembered that it is not only residual fuel oil which matters in that location, but also the "light ends" which are destined to come into the large-scale petrochemical industry which is being developed, and for which the Ruhr is the proper location.

Regarding the fuel oil market in Western Germany, we have perhaps seen an over-optimism which was incidentally shared by the sales organizations of the coal industry itself, which wanted to get into the oil distribution business at its early stages. This has resulted in a very lively price competition which called forth governmental help for the coal industry, resulting in the officially sponsored "Coal-Oil Cartel". Here can be seen the case as of cartel-via-competition referred to earlier on.

Mr Handsman: On the question of location of refineries what does Dr Frankel think about the economics of the new refineries that are projected in many of the smaller, hitherto undeveloped, countries, for instance in the Philippines, Ceylon, Pakistan, etc?

Dr Frankel: The question of whether a refinery should, or could, be built in such a country is a political and economic one. The question whether a refinery should be built in a consumer country depends in the first instance on the ratio of crude oil–finished product prices.

Where the refinery margin which expresses itself in the laid-down cost of crude, if it were imported, and the sum total of finished products as they are imported, is very large, as it was in some of these undeveloped countries, there is much justification for building such a refinery.

When the consumption in a country reaches a certain level and if the geographical set-up of the country is such that its demand can be economically covered from one or two refineries, which is not the case in all countries, then the demand for a refinery is probably legitimate, and has, with some delay perhaps, always been met.

In view of the size of the total requirements in some of these countries it would be difficult for each of the marketing companies to build their own refinery for their own market, and consequently the conception of joint refineries has developed which can be run either by one of the operating marketers also on behalf of others, by neutral entrepreneurs, or, as was the case in Greece, under direct government sponsorship. Cases of several marketers joining in forming a refining company can be found in Ireland, and there are such intentions in Turkey, Ceylon, etc.

Mr Bier: Dr Frankel mentioned the influence of newcomers on the flow of oil in 1958. I suppose he had in mind those in the

Western Hemisphere and the Middle East. What I am wondering is whether perhaps during the same year the revival of the appearance of Russian oil in the West might be included in factors which could in the future also have a larger influence than hitherto on changing to a certain extent the general movements of products and perhaps crude oil.

Dr Frankel: Whereas the impact of Russian exports should not be exaggerated, it undoubtedly is of importance in both directions mentioned earlier on. First it will liven up the competitive activities which on the other hand will also tend to bring in governmental influence in other countries. In Russia the trading body and the government are the same, and this inevitably results in other countries having to adopt governmentally organized methods of trading, *e.g.* quotas. There might also be a call for defensive methods in certain countries which, owing to the difficulties of the industry in organizing itself in view of the American Anti-Trust Laws, can only be adopted by governments.

Mr Watts: Could you say something about the future of the tanker market as it is determined by the production in new areas, the new location of refineries, etc.?

Dr Frankel: There is today a large surplus of tankers and this position is likely to obtain for the next few years; it will be aggravated by some of the pipeline projects if and when they are realized. There is however one consolation inasmuch as the capital requirements for deepsea transport will only be comparatively small when, as we expect it to do, consumption has grown further.

* * *

Personal Notes

Fred A. Davies, chairman of the board of directors of the Arabian American Oil Company, has retired, bringing to a close an active association with Middle East petroleum which spans nearly three decades.

Board chairman since 1952, he was also Aramco's chief executive officer until October 1958, when president Norman Hardy succeeded him in that position.

Previously Mr Davies had been Aramco vice-president in charge of exploration and production, and executive vice-president.

A native of Aberdeen, Mr Davies earned a degree in mining engineering from the University of Minnesota, worked one year with Anaconda Copper, and joined Standard Oil Company of California as a geologist in 1919.

For most of the next ten years he explored for oil in the Rocky Mountain section of the United States. His first contact with the Middle East came in 1930 as a petroleum geologist on Bahrain, where he located the first productive oilwell.

After negotiations for an oil concession in Saudi Arabia were successfully completed, Mr Davies returned to the Persian Gulf area as field manager of both the Bahrain Petroleum Company Ltd, and the newly-organized California Arabian Standard Oil Company. He was holding this post when the first commercially productive oilwell in Saudi Arabia was discovered on Dammam Dome in 1938.

From 1940–1944, he was president of the California Arabian Standard Oil Company. After the Company's name was changed in 1944 to Arabian American Oil Company, he continued as president through 1947.

In addition to his position in Aramco, Davies is a director of the Trans-Arabian Pipe Line Company.

F. A. C. Guepin, managing director of Royal Dutch since 1950, is to retire on 30 June 1959 having reached the age of 60. He has been appointed to the board of directors.

F. A. C. Guepin

A. Hofland, O.B.E., has been appointed a new managing director of Royal Dutch, to take effect from 1 July 1959.

Mr Hofland was born in Amsterdam in 1901, where he graduated in chemistry at the Municipal University in 1925. He entered the service of the Royal Dutch/Shell Group in 1929 and held various positions in Germany and London up till 1939, when he was appointed a member of the management of the subsidiary in Italy. During the last world war he returned to London, and towards the end of the war, and for some time afterwards, held an appointment as adviser to the Allied armies in Italy and to the Military Government in the British Zone of Occupation in Germany. In 1948 he was appointed general manager of Deutsche Shell, which position he held till 1950, when he was appointed manager of European Area Department in the London office. In 1955 he was appointed a member of the board of directors of The Shell Petroleum Company Ltd in London, with special responsibility for the marketing of oil products.

A. Hofland

It is the intention to appoint Mr Hofland, after his appointment as a managing director of Royal Dutch, as a principal director of the board of directors of Bataafse Petroleum Maatschappij NV and a managing director of The Shell Petroleum Company Ltd with effect from the same date.

R. B. Southall, C.B.E., F.Inst.Pet., director and general manager of BP Refinery (Llandarcy) Ltd, has been appointed a vice-president of Swansea University College. He will hold office until the Annual General Meeting of the Court of Governors in 1961.

W. H. Heydon, B.Sc.(Eng.), A.M.I.C.E., has been appointed to the board of directors of William Press & Son Ltd. Mr Heydon, who joined the Company in 1941, has for many years held the position of chief engineer.

Walter Heydon

Following the reconstruction of the Company in 1956, **John C. Hanna,** Jnr, general manager, has now been appointed an additional director of C. R. Averill Ltd.

C. S. Cleverly

C. S. Cleverly, O.B.E., A.M.Inst.Pet., has retired from the position of director and general manager of BP Refinery (Kent) Ltd. **A. W. G. Trantor,** C.B.E., has succeeded him as general manager. Mr Cleverly, a Yorkshireman and an engineer, has served with The British Petroleum Company for 35 years, 22 of which were spent in the Middle East, principally in Persia and Palestine. Prior to his appointment as general manager of Kent refinery at the start of that project in late 1950, he was BP's chief constructional engineer, and is a specialist in the construction of oil refineries, pipelines, and ancillary equipment.

Mr Trantor, an Aberdonian and also an engineer, has served with BP for the last 24 years and was for some time chief engineer of Abadan refinery in Persia. In 1942 he was appointed works manager of Kent refinery, which he commissioned in 1953. A short time later he was appointed general manager of the BP refinery at Aden, which was then under construction and which he commissioned in July 1954.

A. W. G. Trantor

It is announced that **W. Wallace,** M.I.C.E., M.Am.Soc.C.E., F.Inst.P., the managing director of Marine and Remote Centre Oil Installations Ltd (Marcoil), has been appointed a member of the Committee on Pipeline Planning of the Pipeline Division of the American Society of Civil Engineers. The purpose of the Committee is to investigate and correlate studies on pipeline design and economics, to co-operate with existing organizations in the accomplishment of this purpose, and to disseminate this information to the profession.

Launcelot Owen

Launcelot Owen, M.C., A.R.S.M., A.R.C.S., D.I.C., F.Inst.Pet., who will be well-known to many senior members of the Institute, of which he has been a member since 1915, has recently retired under the age regulation from his position as a technical officer with the Standards Association of Australia. During his fifteen years in that post he has been active in the petroleum industry as well, carrying out work as a consulting petroleum geologist and contributing articles on Australasian oil search to the technical and to the lay press. He is continuing his work as a consultant and hopes to visit London in the not too-distant future. Meanwhile he will be glad to hear from old friends, his address being Box 2140, GPO Sydney, New South Wales, Australia.

G. S. Orr

G. S. Orr has been appointed to the position of manager of Mobil Oil Company's Scottish Division, with headquarters in Glasgow. He succeeds **A. Todd.**

Mr Orr joined Mobil in 1928, as a junior in Glasgow, and held a series of office appointments before becoming a salesman in 1949. In 1953 he was appointed branch manager, Northern Ireland, and in 1958 became district manager with the Company's Northern Retail Division in Newcastle.

Mr Todd has been manager of the Scottish Division since July 1955. Prior to this he was branch sales manager at both Newcastle and Glasgow, dealing with industrial and retail marketing.

H. A. Rich

Following the announcement of the construction of a new terminal at Ellesmere Port, **H. A. Rich** is to become division manager of the newly created North-Western Retail Division, and **C. B. Cotterell** is to succeed **W. J. Frier,** who is shortly to retire, as division manager of Northern Retail Division.

Mr. Rich joined the Company in 1928 as an office junior in Bradford. In 1937 he was appointed salesman in north Lincolnshire, where he served until his appointment in January 1956 to the post of district manager in Birmingham. He became manager of the North Midland Retail Division in November 1957.

C. B. Cotterell

Mr Cotterell joined Mobil in 1930 as an office junior in Birmingham, where he remained until becoming a branch office manager in London in 1951. In 1954 he became district manager in the Southern Retail Division. Mr Cotterell is a member of the Institute of Motor Industry and has served on one of the national committees for the last four years.

Mr Frier joined Mobil in 1927. Since the war he has been Marine Sales Branch manager in Liverpool, branch sales manager in Newcastle, and manager of the Northern Retail Division.

National Benzole Company Ltd announces the appointment of **Peter Vey** as public relations officer in succession to **Bruce Patterson,** who is taking up an appointment with The Shell International Petroleum Company.

Before joining National Benzole, Mr Vey was public relations officer of the London Division of Shell-Mex and B.P. Ltd. A former journalist, he worked on the *Surrey Herald*, the *Western Daily Press*, Bristol, and the *Sunday Express*.

Sir Philip Southwell Retires

Sir Philip Southwell, C.B.E.

Photo by Douglas Glass

Sir Philip Southwell, C.B.E., M.C., B.Sc., F.Inst.Pet., who retires as managing director of Kuwait Oil Company at the end of June, having reached the normal retiring age, has held that position since 1946. In the comparatively short period of 13 years since then he has been the leader of a team which has brought into production one of the world's largest and most spectacular oilfields. At the time he took up the position of first managing director of the Company, its operations, which had been suspended during the war, were just being resumed and total crude oil production of Kuwait for the six months of 1946 was under one million tons. Under Sir Philip's leadership production has increased out of all proportion to the size of the country and in 1958 was over 69 million tons. Total production since 1946 has been over 450 million tons and Kuwait's oil reserves have been estimated to be larger than those of any other country. In fact they are believed to exceed the reserves of the entire Western Hemisphere and account for more than 20 per cent of estimated total world reserves today.

The importance of Kuwait developments to Britain are almost without parallel. During the period 1946–58 Britain's imports of crude oil have totalled over 230 million tons and of this amount well over half has come from Kuwait.

Sir Philip, who was president of the Institute during the period 1950–1952, was educated at Birmingham University at the time when Lord Cadman (then John Cadman) was Professor of Mining and had recently established the School of Petroleum Technology there.

After holding the position of Petroleum Technologist to the Government of Trinidad from 1922–28, he joined the then Anglo-Persian Oil Co. Ltd in 1930 and saw service in many different parts of the world—Texas, California, Persia, Iraq, and the Far East—to gain a wealth of first-hand experience in the industry. During the second world war he was responsible for the development of the Nottinghamshire oilfields and brought about their expansion to make an important contribution to Britain's war-time needs of petroleum.

Prior to his election as president of the Institute Sir Philip was a vice-president during the period 1948–50, having been a member of the Institute Council since 1936. He was awarded the Cadman Memorial Medal in 1954 and on that occasion delivered the fourth Cadman Memorial Lecture under the title of "Winning Petroleum". He has contributed numerous other papers to the literature of the science of petroleum technology, is a Fellow of the Geological Society, and a Fellow, and Silver Medallist, of the Royal Society of Arts. He was created a knight in 1958, having previously been appointed C.B.E. in 1953. He was awarded the Military Cross in the 1914–18 war while serving with the Royal Artillery. He is also a knight of the Order of St John. Although Sir Philip retires from the managing directorship of the Company he still remains a member of the board.

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Soviet Withdrawal from World Petroleum Congress

The Soviet Union has cancelled its arrangements to send oil scientists to New York to attend the Fifth World Petroleum Congress.

Notice of this change in plans came in a cable to C. E. Davis, the Congress general secretary, from Professor A. V. Topchiev, vice president of the Academy of Science, U.S.S.R.

It was said that "conditions of a discriminatory nature" had been imposed on Soviet scientists who were to attend the Congress. This referred to the U.S. State Department's policy not to allow the scientists from the Soviet Union to visit certain areas in the U.S.A. unless reciprocal rights to United States oil men were granted by the Soviet Union.

The Department of State has been working on an exchange of petroleum technologists with the Soviet Union for the past year, but has recently been informed that the U.S.S.R. is not interested in arranging such an exchange at this time. Without reciprocity from the Soviet Union the State Department is unwilling to open any areas now restricted for travel to Soviet citizens.

Petroleum Chemical Industry Refresher Course for Science Teachers

Over 200 science teachers from boys' and girls' public, grammar, and secondary schools recently attended a three-day residential course at University College, London. Organized by Shell International Petroleum Company, the course was designed to show teachers how the sciences they teach in schools are applied in a great international industry. Similar courses were held in 1957 and 1958.

The emphasis on this year's course was upon chemistry, and particularly on chemicals from petroleum. After two days of lectures and films, the members went to Carrington, near Manchester, to visit the Shell Chemical Company's plant.

Lecturers included Sir Harry W. Melville, secretary of the DSIR; Professor W. T. Astbury, of Leeds University; Professor R. L. Wain, of Wye Agricultural College; Professor P. V. Danckwerts, G.C., of Imperial College, London; and Dr V. E. Yarsley.

IP Council and Officers 1959-60

At the Annual General Meeting of the Institute on 22 April, C. M. Vignoles, C.B.E., was unanimously re-elected President to serve for the Session 1959–60.

In proposing the re-election, Lord Geddes said that Mr Vignoles had, during the past year, maintained and in fact added to the stature of the office of the President.

MEMBERS OF COUNCIL

At the same meeting it was announced that the ballot for five vacancies on the Council had resulted in the re-election of M. E. Hubbard and the election of four new members—J. G. Annan, G. A. Dickins, J. A. Foster, and L. L. Hosking.

M. E. Hubbard

M. E. Hubbard, B.A., M.I.Mech.E., F.Inst.Pet., a member of the Institute since 1927, and a Member of Council since 1955, has been chairman of the IP Economics and Operations Group since 1957. After studying engineering at Cambridge University he joined the Anglo-Persian Oil Company (now British Petroleum Company) in 1924. For the first 20 years of his career he was mainly concerned with the construction of oil refineries, notably in France where he was resident from 1925 to 1939. Subsequently he became responsible for the forward planning of the BP Group's post-war developments. For the last few years he has been mainly occupied on the international aspects of oil, and the economic and technical factors affecting the future requirements of oil in relation to other forms of energy. As manager of Economic Relations Department he is responsible for maintaining contact with international bodies such as OEEC and the UN regional organizations.

J. G. Annan

J. G. Annan, B.Sc., M.Inst.Pet., who joined the Institute in 1939, has been a member of its Scottish Branch since 1939, and the Honorary Recorder of the Branch for the past year. Graduating from Edinburgh University, he joined the Pumpherston Oil Company as a chemical assistant in 1923 and a year later was transferred to BP Refinery (Grangemouth) Ltd as assistant Chief Chemist. In the second world war he saw service in the Middle East and Italy, where he became a major in the RASC, and in 1947 was appointed Chief Chemist at Grangemouth. He is at present production superintendent at the refinery, a post he has occupied since 1954.

G. A. Dickins

G. A. Dickins, B.Sc., F.R.I.C., F. Inst.Pet., graduated in Honours Chemistry at Durham University in 1938. He joined H.M. Forces in 1939, was commissioned in the Royal Engineers in 1940, and served in various capacities both in the U.K. and India, the final period being spent as Staff Major in India. Demobilized in 1946, he joined the staff of the Royal Military Academy, Sandhurst, as senior lecturer concerned with courses in chemistry, fuels, and explosives.

Early in 1951 he joined the Central Laboratories of the (then) Vacuum Oil Company Ltd, at Wandsworth, as supervisor of the Analytical Section and later that year assumed control of the laboratories.

Late in 1955 was appointed as manager of the Technical Services Department of the (now) Mobil Oil Company Ltd, and became responsible for the quality of all Company products together with associated technical services development, etc.

He has served on several panels and sub-committees of the Institute and is at present a member of the Standardization Committee and of the Hydrocarbon Research Group. He previously filled a casual vacancy on the Council during the session 1957–58.

A. J. Foster

A. J. Foster, M.Inst.Pet., joined Anglo-Mexican Petroleum Company in 1918, serving in the Buying Department until January 1921, when he was transferred to the newly-formed Shell-Mex Ltd. There he was assigned to the Installation Operations Department where he served continuously until the formation of Shell-Mex and B.P. Ltd in 1932. In particular he played a significant part in the development of waterfed sub-installations and depots, and the organization of inland transport of products by barge.

He served as assistant manager, Traffic and Stocks Department, Shell-Mex and B.P. Ltd, until the outbreak of war, when he joined the Petroleum Board as assistant manager, Stocks and Terminals Department, later becoming manager. Amongst other things his duties included liaison with the Admiralty and M.O.W.T. on the allocation of tankers from incoming convoys, and the provision of coasting tankers for the D-Day operations and after.

Appointed manager, supplies and transportation, Shell-Mex and B.P. on the dissolution of the Petroleum Board, he became, in 1950, general manager—supplies, with responsibilities for the Purchasing, Technical, and Supplies and Transportation Departments.

L. L. Hosking

L. L. Hosking, B.E., M.I.C.E., A.M.N.Z.I.E., F.Inst.Pet., was educated at Canterbury University, New Zealand, and from 1934 to 1937 was employed with the New Zealand Ministry of Works and Harbour Board. He then joined the Shell organization and was engaged on exploration work in Papua until 1938, when he returned to New Zealand on engineering duties related to marketing services.

During 1940–46 he saw war service with Royal New Zealand Engineers in the South Pacific area and with the Royal Engineers and Allied Land Forces in SEAC, rising to the rank of Lieutenant-Colonel. In 1946 he returned to marketing engineering work in New Zealand and Malaya and in 1951 was placed in charge of marketing operations in New Zealand. During 1956 and 1957 he was administrator of Pulo Bukom, the large bulk storage and tanker distribution centre in Singapore. In 1958 he joined the Shell Petroleum Company Ltd as its chief engineer and on 18 March 1959 was appointed head of Marketing Operations in Shell International Petroleum Company Ltd.

HONORARY OFFICERS

The following honorary officers were also elected at the Annual General Meeting in accordance with the By-Laws:

Honorary Secretary

W. M. Catchpole

W. M. Catchpole, M.A., F.Inst.Pet., a member of the Institute since 1935 and a member of the Council since 1958. Educated at Radley College and Caius College, Cambridge, entered the petroleum industry in 1933 by joining the Sunbury Research Centre of the British Petroleum (the Anglo-Persian Oil) Company. In 1935 he went to Persia and in 1943 was appointed chief chemist of the Abadan refinery. On his return to the United Kingdom he joined the Company's Process Development Branch in 1947 and in 1953 was appointed to his present position of chief research chemist in charge of the Petroleum Division at Sunbury Research Centre.

Honorary Editor

Dr E. B. Evans

E. B. Evans, M.Sc., Ph.D., F.R.I.C., F.Inst.Pet., honorary editor since 1955, was formally elected to that post for the next year. A member of the Institute since 1928, Dr Evans was first elected to the Council in 1939 and served as a vice-president on three occasions—1948–50, 1951–54, and 1955–58. A member of the Publications Committee from 1939, he was appointed honorary associate editor in 1946, and, during the period 1944 to 1947 was a member and honorary secretary of the Hydrocarbon Research Group. He has served on many other committees of the Council, including the Standardization Committee.

His first association with the petroleum industry was in 1926 when he joined the Esso Petroleum (then Anglo-American Oil) Company Ltd as a chemist at Purfleet. He moved to the Vauxhall laboratories and later to the Technical Sales Department, and during the second world war was seconded to the Chemical Department of the Petroleum Board. When Esso Development Company (now Esso Research) Ltd was founded in 1945 he was transferred to that company and attained his present position of chief chemist in 1950. He was awarded the Eastlake Medal of the Institute in 1957.

Honorary Treasurer

O. F. Thompson

O. F. Thompson, O.B.E., M.Inst. Pet., started in the petroleum industry in 1925 and in the 1930's spent several years in America with the production, refining, and marketing activities of the Shell Oil Company. He later held a management post with the United British Oilfields of Trinidad. During the war he was responsible for petroleum in the Ministry of Economic Warfare. More recently he has been manager of the Trade Relations Department of the Shell Group in London. He was a Member of the Council of the Institute from 1951 to 1957 and during this time he was the first chairman of the Economics and Operations Group.

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TANKER ORDERS AT THE BEGINNING OF 1959

The Westinform Shipping Report No. 129, published recently, surveys the world tanker order book as at 1 January 1959, analysing the orders, according to country of build, ownership, size, and estimated delivery date. Relevant comparisons are made with the position twelve months previously, which was the subject of an earlier Westinform Report.

For all analyses except that of the building countries, a clear distinction is made between tonnage on order for oil companies and for independent owners.

New orders in 1958 were scarce compared with the 1957 rush, but launches and completions increased, reaching a record level for the year as a whole. Total orders at 1 January 1959 were lower than a year earlier by some 20 per cent, owing not only to the lack of new orders but also to a substantial volume of cancellations.

Examining the building countries, Japan leads both in total tonnage and in average size of vessel. The United Kingdom is second on a tonnage basis, followed by Germany and Sweden. All the major national ownership groups show a decline in tonnage on order, and this applies both to oil companies and independent owners. Distribution of orders by size groups reveals heavy concentrations in the 30–32,000 ton and 46–48,000 ton ranges.

The average period from ordering to completion is substantially narrowing, and consideration is given to the implications of this both for owners and for shipyards in the years immediately ahead.

Separate copies of this report may be obtained from W. G. Weston Ltd, 47–48 Piccadilly, London, W.1, at a cost of £2 each.

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Pipeline Handbook

The Petroleum Engineer has recently published its annual "Pipeline Handbook Issue" and this contains a mass of data, formulae, and tables useful to anyone concerned with the design of large or small pipelines. Its 112 pages cover all aspects of the subject, including materials and construction, gas flow formulae, gas transmission, crude and products pipeline, and storage data. Enquiries should be addressed to Charles McKean, The Petroleum Engineer, P.O. Box 1589, Dallas 21, Texas.

Petroleum in Parliament

Oil Imports from the U.S.S.R.

The President of the Board of Trade was asked on 14 April how many licences had been granted for the importation of oil from Russia; for what quantity; how many applications had been made for licences; and what were his reasons for not granting them for a five-year period instead of annually.

In reply it was said that over the last five years no application had been refused outright; one had been modified; and 25 had been granted for 526,000 tons of oil, not all of which had been imported. In addition 140,000 tons had come in under 41 individual licences on issue to long-established importers. As oil was now in surplus supply it was necessary to deal with imports on an annual basis.

The questioner replied that Russian oil was being offered at half the price of the Anglo-American counterpart and that many more firms would take it if they could have assurances of a five-years' supply. Since the Russians had indicated that they would take part of the price in barter, and therefore help production in Britain, would not the granting of longer-term licences be considered?

The Minister said he was not aware of the price differential which had been mentioned, and that it would not be wise to tie up our imports by giving a five-year licence.

Liquid Methane Imports

The Paymaster-General, among other questions on the number of tankers to be built for the transport of liquid methane, which he was unable to specify at this stage, was asked on 20 April what was the amount of coal equivalent of a full cargo of liquid methane carried by the *Methane Pioneer*, and approximately how many round trips could it make in a year. The answer was about 5000 tons and 7½ round trips.

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Middle East Oil Production

	March	*Jan-Mar*
	Tons	
Iraq Petroleum Co. Ltd ...	2,074,634	6,124,345
Basrah Petroleum Co. Ltd ...	1,049,786	3,068,639
Mosul Petroleum Co. Ltd ...	110,306	320,677
Qatar Petroleum Co. Ltd ...	700,292	1,986,665
Iraanse Aardolie Exploratie en Productie Mij	3,987,000	10,448,000
Kuwait Oil Co. Ltd	5,720,920	16,682,180
	Barrels	
Arabian American Oil Co. (Saudi Arabia)	35,945,948	97,895,983
Bahrain Petroleum Co. Ltd ...	1,399,397	4,072,066

The refinery throughput at Abadan of the Iraanse Aardolie Raffinage Mij for March was 1,386,000 tons, the total for 1 January to 31 March being 3,701,000 tons.

Crude processed at Aramco's Ras Tanura refinery during March was 6,258,952 brl, the total for 1 January to 31 March being 16,754,262 brl.

Oil deliveries from Sidon, Lebanon, by Trans-Arabian Pipeline Co. in March were 13,968,222 brl, the total for 1 January to 31 March being 37,792,262.

The IP Building Committee 1954-9

A Brief Review of Its Work

An *Ad Hoc* Building Committee was appointed by the IP Council on 10 November 1954; the Committee consisted of Sir Stephen Gibson (chairman), the president of the Institute; the honorary officers, G. H. Coxon and C. Chilvers; and four members of Council chosen by the chairman of the Committee, who were the then chairman of the Finance Committee (H. Hyams), A. C. Hartley, J. A. Oriel, and O. F. Thompson.

The terms of reference for this Committee were:—

(a) To make full enquiries regarding a suitable building that would provide the Institute with a worthy headquarters of which it could be justly proud;

(b) To prepare detailed schedules of the cost involved, including decoration, furnishing, and new equipment;

(c) To prepare a detailed plan for financing such a project;

(d) To report their conclusions to Council for a decision.

In the discussion which had preceded the appointment of the *Ad Hoc* Committee, the chairman of the Finance Committee had stated that the Institute had available in the capital and revenue reserves £20,000 that could be used for a building, and suggested that a further sum of £30,000 might possibly be borrowed on mortgage for the purchase of a suitable property.

The *Ad Hoc* Committee reported to Council on 28 July 1955, that:—

(a) A suitable building under the terms of reference had been found at 61 New Cavendish Street, on which a 999 years lease could be obtained for approximately £20,000.

(b) An estimate of the cost of repairing and decorating this building was £43,000 and that for approximately £9000 a lecture theatre could be constructed in the basement. Council were informed that including the purchase of the lease, a sum of not less than £80,000 would be required for this building.

(c) The raising of money by mortgage was no longer possible, owing to the curtailment at that time of loan facilities, and it was suggested to Council that an approach should be made to the oil industry for the necessary finance after the lease had been purchased by the Institute with its own reserves.

Council authorized the purchase of the lease of 61 New Cavendish Street at a price not exceeding £20,000 and appointed the *Ad Hoc* Committee to be the Building Committee, with authority to appeal to members of the Institute and to the industry for the funds necessary to modify and repair the building, including the provision of a lecture theatre. This Building Committee was later joined by Lt-Colonel S. J. M. Auld, E. LeQ. Herbert, T. W. Mathias, M. E. Hubbard, and Lord Geddes, when he became president.

At the end of January 1956 an appeal was made to corporate members and member companies for contributions to the building fund, and £25,000 was received by the middle of May 1956.

In the meantime a detailed estimate of the cost of the work required was made by contractors, and Council were informed at the meeting on 20 June 1956 that the total sum required would be approximately £110,000, including the purchase of the lease and the provision of the lecture theatre at a cost of £14,000. Council decided the work on the project should proceed.

By November 1956 subscriptions to the building fund by corporate members and member companies amounted to just over £30,000 which, with the £20,000 from the Institute reserves, provided £50,000 towards the total requirement of £110,000. The Building Committee decided that the major oil companies should now be approached for contributions. They contributed £55,000.

In February 1957, during work on the foundations of the building, it was unexpectedly found that a good deal of timber, instead of brickwork, had been used in the original construction. This timber was in a decayed state, and in consequence the district surveyor insisted on a very considerable amount of extra work being done, the estimated cost being between £6800 and £9000. (The ultimate cost was approximately £7500.)

At a Council Meeting held on 6 March 1957 it was decided to set aside a sum of £10,000 from revenue as a building contingency fund to cover this and other unforeseen costs.

The only other additional expenditure incurred during the work on the building was £575 for setting a wall back 13 inches to provide that amount of extra width in the lecture theatre, and £300 for the internal telephone system.

The final total cost of the building itself was £110,683. This does not include furniture and furnishings, the cost of which was £8215 and which is in effect expenditure in excess of estimates, and almost entirely due to the additional work required by the district surveyor.

It is perhaps desirable to recall that the 999 years lease of 61 New Cavendish Street carries with it the lease of the adjoining mews property, 33 and 33A Weymouth Mews. The Institute owns the leasehold of both properties, which is sublet for a term of 999 years. The Institute pays the ground rent of £60 per annum and the insurance premium on this property, and recovers from the tenants.

The tenants are responsible for all repairs and maintenance, and it is extremely unlikely that the Institute will incur any loss in regard to this property.

In the course of the work on the building, three murals were found in addition to those that have been restored. These three have been painted over, and it is suggested that they should be cleaned and restored when a suitable opportunity offers.

Having completed the duties for which it was appointed, the Building Committee requested that Council terminate its responsibilities and, at the Council meeting of 1 April 1959, the Building Committee was dissolved.

Notes of the Month

Iraq Oil Situation

To remove mis-understandings which may have arisen from press reports and comments on the statement made by the Iraqi Minister of Economics on 26 April, the Iraq, Basrah, and Mosul Petroleum Companies give the following clarification of certain points:

(1) As regards future production the Companies are engaged on projects to expand their production and transport facilities to a capacity of 70 million tons/year by 1962. On completion of these projects as planned, export capacity will be double that of 1958 but the actual increase in production will depend on market conditions at the time.

(2) Since they have no intention of participating in the establishment of oil refineries in Iraq, the Companies are at a loss to interpret the comments attributed to the Minister in connexion with the building of oil refineries.

(3) The position regarding the export of refined products is that the Companies supply crude oil under special arrangements for the government refineries at Daura, Qaiyarah, and Muftiah for the purpose of satisfying the home market. The Companies have now agreed that any incidental surpluses from the operation of these refineries at their existing designed capacity, may be exported.

(4) Since 1952 the Iraq Government has been entitled to take in kind twelve and a half per cent of oil production as part of its equal share of profits. Formerly the Government was required to give six months' notice of its intention to take such oil in the following year. At the Government's request, the Companies have recently agreed to the Government exercising this option quarterly instead of annually and to reduce the period of notice to the practical minimum.

Drilling in Southern Iraq

In August of this year Keir & Cawder Arrow Drilling (U.K.) Ltd, of Bishopbriggs, Glasgow, will begin drilling operations on behalf of Basrah Petroleum Company on the Rumaila oilfield in southern Iraq. Heavy equipment, including two drilling rigs capable of drilling to depths of 12,000 feet, is now being assembled in the U.K.

It is anticipated that the rigs, together with all ancillary equipment, will be shipped in time for assembly at site during July, and spudding of the first new wells will take place in mid-August. For transport across the desert between locations the complete rigs will be mounted on tracks driven by Caterpillar tractors.

New Well in Western Nigeria

A new exploration well, known as Benin West, is being drilled by Shell-BP on the bed of the Apata Creek, in Ondo Province, in the Western Region of Nigeria.

The Shell-BP's drilling barge, was towed to the new site from Ikang, in Calabar Province, (Eastern Region), having completed drilling an exploration well which was abandoned as a dry hole at a depth of 11,189 feet.

UOP Trading on New York Exchange

Trading in Universal Oil Products Company stock started on 1 April on the New York Stock Exchange. Ticker symbol for Universal Oil Products is UOP.

UOP has served the petroleum industry for more than 40 years through the development and licensing of processes used for refining oil, and in the production of petrochemicals. It furnishes operating and maintenance services to refiners and, through a subsidiary, furnishes engineering and construction services to the process industries. The company also manufactures catalysts, oxidation inhibitors, additives, and antiozonants to the petroleum, chemical, rubber, and food industries.

Until 11 February 1959, UOP was owned by The Petroleum Research Fund, a charitable trust, and The American Chemical Society was the recipient of the net income from the trust for use in advanced scientific education and fundamental research in the petroleum field. The Company is now publicly owned as a result of a public sale of 2,900,000 shares of stock which netted $68,701,000.

UOP executive offices and laboratories are located at Des Plaines, Ill. Pilot plant and manufacturing facilities are at McCook, Ill., and principal manufacturing facilities for catalysts are at Shreveport, La.

Gas Injection in Saudi Arabian Fields

The Arabian American Oil Company have announced the start-up of a new 830 million gas injection plant in the 'Ain Dar area of the Ghawar Field.

The plant, built 30 miles west of Abqaiq, is capable of compressing and putting back into the oil reservoir approximately 210 million cubic feet of gas a day. It will serve the dual function of conserving presently unused gases and of assisting in maintaining reservoir pressure.

Gas is gathered from five gas-oil separator plants and compressed at the plant from an intake pressure of 125 psi to a discharge pressure of 2100 lb in five stages. The gas is then put into five injection wells which are on the crests of two structural closures in the 'Ain Dar area.

Construction of the plant began in November 1957, and is the newest installation in Aramco's gas conservation schemes. The first gas injection plant in Saudi Arabia, located in the Abqaiq field, began operating in 1954. New centrifugal compressors and a third injection well in 1958 increased the capacity of this plant from about 150 million to approximately 205 million cu ft/day.

Aramco has been the leader in the Middle East in gas conservation, and its injection plants are among the largest in the world. Completion of the 'Ain Dar plant and enlargement of the Abqaiq gas injection facilities will result in the conservation and industrial use of 66 per cent of the gas produced in Saudi Arabia.

The injection plant was designed by a team of Aramco and Brown and Root Inc engineers in collaboration with Compania Techniche Industrie Petroli, an engineering contractor from Rome. Off-site facilities were designed by Aramco Overseas Company engineers in The Hague. Construction was by Aramco, International Bechtel, and Saudi Arab contractors.

More Drilling in Papua

To clarify the prospects of commercial oil in the general area of Puri No. 1 well in Papua, Australasian Petroleum Company, in which BP is associated with American and Australian interests, has begun a new appraisal and testing programme.

Meanwhile helicopter access to the Bwata structure, some 15 miles to the north-west of Puri, has been gained and the site is being prepared for a borehole to test the limestones which contained oil at Puri.

It is expected that £A3 million will be spent over the next 16 months.

Turkey's New Refinery

The award of an engineering contract for a 65,000 bd refinery at Mersin, Turkey, to the Foster Wheeler Corporation of New York, was announced recently by Mobil International Oil Company, a division of Socony Mobil Oil Company Inc. The $50 million refinery is scheduled to go on stream in late 1961. It is being built at the request of the Turkish Government by four companies affiliated respectively with the British Petroleum Company Ltd, California Texas Oil Corporation, Mobil International Oil Company, and the Shell International Petroleum Co. Ltd.

Preliminary site investigation work is already underway, and construction is scheduled to begin in about October. The initial installations will include a crude distillation unit, a catalytic reforming unit for upgrading naphtha, and a kerosine desulphurization unit. These units will be designed to process Middle East crude, and will produce automotive gasoline, kerosine, diesel fuel, and heavy fuel oil required by the Turkish market.

The refinery will have two tanker berths capable of handling simultaneously two vessels of up to 50,000 tons each. A smaller white products pier will accommodate a 20,000-ton vessel, and a barge wharf also will be built.

The refinery will be operated by Anadolu Tesfiyehamesi, A.S. (Atas), a company incorporated under the laws of Turkey and owned by the four companies mentioned above. Mobil International is acting as agent for Atas in connexion with the construction and engineering of the refinery. The products made by the refinery will be marketed by affiliates of Mobil, Shell, and BP. Caltex distributes products in Turkey through Petrol Ofisi, the government marketing organization. The terms of the agreement with the Turkish Government provide that the new refinery may process imported crude oil until production of Turkish crude of suitable quality becomes available.

Together with an existing refinery at Batman in south eastern Turkey, the new refinery at Mersin will be able to meet all of Turkey's needs for petroleum products for some time to come, with the exception of lubricants and aviation gasoline.

Extension to Pernis Synthetic Glycerine Plant

Shell Pernis Chemische Fabrieken NV announces that the capacity of the synthetic glycerine plant at Pernis (Rotterdam) will be increased. As a first stage in the expansion programme the capacity will go up to a minimum of 15,000 tons/year. The production from the increased capacity is expected to become available early in 1960.

This synthetic glycerine plant, which is the first of its kind outside the U.S.A., is part of a highly-developed complex of chemical plants. The decision to increase capacity has been taken within a year of the commissioning of the original plant.

New Coking Unit at Paulsboro Refinery

The new 19,000 bd delayed coking unit designed, engineered, and constructed by The Lummus Company for Mobil Oil Company, a division of Socony Mobil Oil Company Inc, at their Paulsboro, New Jersey, refinery is on its initial run.

The coker, comprising four coke drums 19 feet in diameter by 63 feet tangent to tangent, is designed for 764 tons/day of coke, making it the largest initial capacity coker ever built in the U.S. The feedstock is a mixture of seven various reduced crudes or blends of residue, whose gravity varies from 3–14 API including furfural extract, duosol tar, and propane deasphalting tar.

A view of the new coking unit

The unit cokes the heavy residual stocks withdrawn from other refinery units which previously were blended into fuel oil. The coker makes seven products: fuel gas, butane-butylenes, light and heavy gasolines, light and heavy gas oils, and coke.

In addition to the coking section, the unit includes: a gas recovery section, sulphuric acid treater for gasoline, amine treater for light hydrocarbons, and a caustic treater for the butane-butylene stream.

Esso's New Dutch Refinery

A contract worth more than £300,000 to supply and erect six Petro-Chem Iso-Flow furnaces at the new Esso Nederland oil refinery in the Botlek area, near Rotterdam, has been awarded to Birwelco Ltd, of Aston, Birmingham.

The furnaces range in size from 20 million to 90 million Bth/hr and the largest is about 27 ft in diameter and 138 ft high. The hydrofiner furnace is of novel construction and comprises three independent coils in one shell with a total duty in excess of 55 million Bth/hr. The reheat furnaces in the powerformer train are also housed in one shell.

The furnaces are connected to a common stack and are designed for high efficiency. To achieve this some of the furnaces utilize convection sections either separate or integral.

The main contractor is Badger N.V. of The Hague, and this firm is responsible for the design, engineering, and construction of the whole refinery. Design capacity is 100,000 bd and completion is expected early in 1960.

Irish Refinery Operating

The first cargo of crude oil arrives at the new Whitegate, Cork, refinery

Ireland's first oil refinery, owned by the Irish Refining Co. Ltd. and situated at Whitegate, County Cork, is nearly complete. The first shipment of 1000 tons of gas oil, provided by the three participating companies, Caltex, Esso, and Shell-Mex and B.P., arrived in the first week of April for test purposes on the new crude distillation unit.

A few days later, on 13 April, the first cargo of crude oil arrived—15,600 tons carried on the *Caltex Dublin*. The marine terminal, which at present can accommodate tankers of up to 33,000 tons dw, will be able to take vessels of up to 65,000 tons when the dredging programme, now in progress, is completed.

Much work has yet to be done at the refinery, but nevertheless the major part of the plant is now complete, and operations were begun in May, two months ahead of schedule. The planned crude capacity of the plant is 2 million tons year.

The cost of the refinery, £12 million, is the largest industrial investment ever made in the Irish Republic.

Helium Operations in the U.S.A.

The director of the U.S. Bureau of Mines, Marling J. Ankeny, recently gave an address to the Conservation Committee of the National Association of Manufacturers, in New York, on "Bureau of Mines' Research and Achievements in the Natural Resources Field".

On the subject of helium Mr Ankeny said it was the one natural resource whose production had been virtually the sole responsibility of the Bureau. A helium programme had been inaugurated during the first world war, and since 1925 it had had full responsibility in the Federal establishment for both production and conservation of helium.

About one million cu ft of helium was now being produced daily. A new helium plant capable of producing three quarters of a million cu ft day was under construction at Keyes, Oklahoma. Of the total U.S. production, roughly 80 per cent went directly to the armed services, the Atomic Energy Commission, and other Federal agencies. The remaining 20 per cent was reserved for private consumers but virtually all was used on defence contracts, in hospitals, or by research laboratories.

The annual consumption of helium had increased fivefold since 1950, and demand would continue to rise, for it was used in rocketry, nuclear reactors, and low-temperature processes still in the early stages of development.

The Bureau's director emphasized the resulting need for a comprehensive long-range conservation programme. No important new helium-bearing natural gas deposits had been discovered in the U.S.A. in the last fifteen years, whilst known resources of helium were being wasted rapidly—almost four thousand million cu ft of recoverable helium would be wasted this year. Helium-bearing natural gas was consumed in domestic and industrial stoves and furnaces, and passed into the atmosphere without serving any useful purpose. If this wastage continued the U.S. might not have enough helium to meet requirements beyond 1980.

The Government however, Mr Ankeny said in conclusion, had announced the commencement of a new national conservation policy designed to save from wastage an estimated 32,000 million cu ft of helium. Legislation to implement this policy had been recommended by the President, and a number of natural gas producers had shown interest in the programme. If legislation were enacted, industry would be invited to participate by financing, building, and operating plants to produce helium for sale to the Government for storage until needed, providing a continuing supply for Government and industry in the future.

Marine Drilling Mover Towed by Sea to Venezuela

First of its kind to be built in Europe, a 400-ton diesel-electric floating crane left Amsterdam recently on tow 4700 miles to the Lake Maracaibo oilfields, for use by Compania Shell de Venezuela.

Called the *Atlas*, the unit will speed up oil operations considerably, since it will transport a complete drilling floor and derrick, including all floor equipment, and drill pipe racked in the derrick, from one foundation to another. The rigging up and down of the derrick and other equipment will no longer be necessary.

With this new mover it will also be possible to move in two lifts, a complete block station including two 1000–1500 brl tanks, six oil and gas separators, and up to six pipeline delivery pumps. This will eliminate the present system whereby these lake installations are fabricated on land, then partially dismantled, and moved to the lake location for re-erection.

The mover consists of a 130 ft by 72 ft barge on which is mounted an A-type crane, capable of a 400-ton lift. Each of the two jibs will have two lifting tackles, each having a lifting capacity of 120 tons, which may be used independently in any combination. Four tackles, each adjusted to a load of 24 tons, will control the movement of the load sideways. The crane winches will be powered by 110-hp electric motors fed by dc generators run by diesel engines. A single operator will handle the entire elevation system by means of a control panel.

The *Atlas* was manufactured by Messrs Verschure, of Amsterdam, and towed by the Dutch tug *Barendsz-zee*.

The "Atlas" on its way from Amsterdam to Ijmuiden, port of the Netherlands on the North Sea

Ship Conversion to Gas Turbine Propulsion

An enterprise in ship modernization has been carried out at the South Bank, Middlesbrough, yard of the Smith's Dock Company Ltd.

The steam machinery of the s.s. *Goodwood* has been removed and replaced by a free piston gas turbine installation of double the power. The new machinery takes up no more space, uses no more fuel, and being lighter in weight by some 50 tons, is very attractive to shipowners possessing tonnage which is now uneconomical under modern trading conditions.

This conversion, carried out for the owners, William France, Fenwick and Co. Ltd, is the first example of a conversion to free piston gas turbine propulsion to be carried out as a private venture.

The vessel was built as a coal-burning steamer in 1949 and was subsequently converted to oil firing. The ship's original machinery developed 950 ihp which gave a service speed of 10 knots on an oil fuel consumption of 10 tons/day for all purposes.

A free piston installation capable of a maximum continuous output of 2000 shp was chosen, which permits operation at the relatively easy rating of 80–85 per cent of continuous maximum for the desired service speed. At the proposed service power of 1700 shp the designed main engine fuel consumption is 7·7 tons/day, and with the combined steam and electric auxiliary plant adopted in this case, an all-purposes consumption of 10 tons/day is anticipated.

Generally speaking the conversion cost is lower than for a conversion to diesel engine propulsion, since the geared drive permits a shaft speed to be chosen which enables the existing shafting to be used, thereby saving considerable expense.

Atomic Radiation Hazards in Research

Dr James F. Black of Esso Research and Engineering Company recently described the Company's experiences with radiation in a statement to the Sub-committee on Research and Development of the U.S. Congress Joint Committee on Atomic Energy, which is considering employee radiation hazards and workmen's compensation in the atomic energy field.

Dr Black reported that the radiation laboratory at the Esso Research Centre at Linden, N.J., houses some 16,000 curies of radioactive cobalt. Safety is ensured by an intricate series of electrical and mechanical interlock systems so designed that it is impossible for employees to expose themselves to radiation.

Over the past five years the largest cumulative exposure received by a single individual was only 290 milliroentgen, about 1 per cent of the dose which the recent stringent requirements of the International Commission on Radiological Protection would permit him to receive during this period.

Dr Black, also vice-chairman of the New Jersey State Commission on Radiation Protection, described radioisotopes as very versatile and valuable research tools and said Esso Research had made excellent use of them with perfect safety.

Esso Research is engaged in an extensive radiation research programme designed to develop further the use of radioactive materials in the petroleum industry. Using radioisotope techniques, the Company recently developed a new formula for gasoline. Radioactive engine parts help in developing lubricants with superior anti-wear properties.

U.S. Government and Industry Converse

U.S. Secretary of Commerce, Lewis L. Strauss, welcomes Dr Alex G. Oblad, vice president of research and development, The M. W. Kellogg Company, New York, to the opening of the U.S. Patent Office Chemical Industry Exhibit and Industry—Commerce Conference. Dr Oblad attended at the invitation of U.S. Commissioner of Patents, Robert C. Watson (far right). *Harry Palmer, manager, Kellogg Patent Department* (second from left) *looks on. M. W. Kellogg has been awarded* 393 *U.S. Patents since* 1946

BP's First 1959 Tanker Launching

The first tanker to be launched this year for BP Tanker Company went down the slipway at the Wallsend-on-Tyne yard of Swan Hunter and Wigham Richardson recently. She was named *British Destiny*, and was the fifth 42,000-dwt tanker to be launched for the Company. Two vessels of similar size are still on order.

One of BP Tanker Company's smaller vessels, the 15,500-dwt *British Fulmar*, launched on the Clyde in September last, has made her maiden voyage. She loaded oil products from Llandarcy refinery, and completed loading at Kent refinery before sailing for Denmark.

Launch of Biggest European-Built Tanker

The largest tanker to be built in Europe was launched recently at Uddevalla, Sweden. The vessel, the *W. Alton Jones*, of 69,000 dw tons, is being built by Sorviksvarvet AB, a division of Uddevallavarvet AB, for Ships Inc., a subsidiary of Cities Service Company. The first of a new series of three supertankers to be built by the Swedish company for use by Cities Service in transporting crude oil to the East Coast of the United States, the vessel is 824 feet 8 inches in length overall, 116 feet in width, and 56 feet in depth. Her capacity will be 610,500 barrels and, with engines of 22,000 hp, she will attain a speed of 16 knots. The Uddevalla shipyard had to be reconstructed to accommodate her. Her displacement of 88,850 long tons is greater than that of the largest European-built ocean liner, the *Queen Elizabeth* being 79,181 tons.

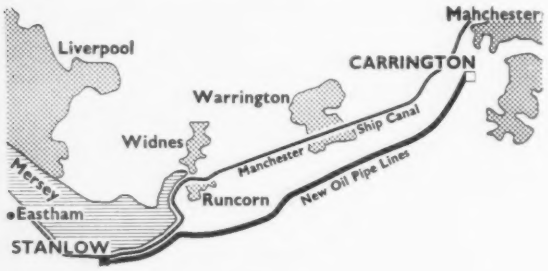
Built at a cost of 812,500,000, the contract for building the s.s. *W. Alton Jones* was signed on 30 January 1957, the keel laid on 31 July 1958, and estimated date of delivery is 30 June 1959.

Stanlow-Carrington Pipeline

Work has started on the laying of four underground pipelines, costing in the region of £1 million, to connect the Shell refinery at Stanlow with Shell Chemical Company's Carrington works near Manchester. The work has started simultaneously from both ends. In addition to the four Shell Chemical Company pipelines, there will also be two pipes for Shell-Mex and B.P. Ltd.

The Shell Chemical pipelines will be used for transferring feedstock, chemical intermediates, and finished products between Stanlow and Carrington, and it is expected that the pipeline system will be completed by the end of 1959.

In order to cause as little disturbance as possible, the pipelines will be laid in four-mile stretches to a minimum depth of 2 feet 6 inches below ground.



The pipes will be in continuous operation and, to prevent corrosion, are bitumen coated and will have cathodic protection. Welds are being X-rayed before they are covered over to ensure complete safety. All the existing services over the route will be maintained during and after the pipe laying.

The route will be marked above ground and line-walkers will inspect the entire route every day.

New Shell Company in the Bahamas

The Shell Company of The Bahamas Ltd has been formed to take over the business in the Bahama Islands of The Shell Company (West Indies) Ltd. This will permit extension of its activities beyond the present supply of aviation products, lubricants, bitumens, and chemical products.

With this object in view The Shell Company of The Bahamas Ltd has appointed Petroleum Distributors of The Bahamas Ltd as its exclusive distributor to the retail market. Its directors are Neville Roberts and E. Dawson Roberts.

The Shell Company of The Bahamas Ltd is at present erecting the main ocean storage installation at Clifton Pier alongside the Bahamas Electrical Corporation's new power plant. The completion of this main installation is scheduled for the end of September.

Tanker Launchings in Italy

The third and fourth of six 35,000 dw ton tankers being built in Italy for BP Tanker Company were launched in April.

At the Genoa yards of Ansaldo SpA, the *British Beacon* was launched on 19 April, and on 28 April the *British Lantern* was launched from the Cantieri Riuniti dell' Adriatico yard at Trieste.

CBMPE Subsidiary Formed

British Oil Equipment Credits Ltd, a subsidiary company of the Council of British Manufacturers of Petroleum Equipment, has been formed to promote schemes for the sale, on deferred terms to overseas purchasers, of capital plant and equipment made in the United Kingdom for the petroleum industry.

The chairman of the company is E. F. E. Howard of Hayward Tyler & Co. Ltd, the managing director is G. V. Sims, director of the Council, and Miss D. B. Jaques is the company secretary. The address is that of the Council at 2 Princes Row, Buckingham Palace Road, London, S.W.1.

The new company has since signed an agreement with PEMEX for the supply of three and a half million pounds worth of British-made equipment for an extension to the Minatitlan refinery in Mexico. PEMEX is shortly opening an office in London under Senor Ingeniero Alejandro Torres.

Pipeline Industries Guild

The Second Annual Dinner of The Pipeline Industries Guild was held at The Connaught Rooms, London, on 10 March 1959, when more than 250 members and guests attended.

In the absence of both the chairmen, S. J. Manning, and Captain J. W. Esmonde, who were in the Middle East, the chair was taken by the deputy chairman, C. C. Bates, who introduced Rear-Admiral N. A. Copeman, C.B., D.S.C., the Fourth Sea Lord.

Admiral Copeman laid accent on the importance of oil in defence, and, therefore, on the activities of the pipeline industry, fulfilling as it did great services by the laying of oil, gas, and water pipelines. He went on to talk about the new ships joining the Fleet, and to mention that the use of gas turbines and nuclear propulsion were envisaged as practical additions in the early future; the latter covering both submarines and tankers.

In his response Mr Bates spoke of the founder of the Guild, J. W. Jones, who had come over from Holland specially for the "big spread" operation. He said that it was interesting to note that the BSI had recognized the Guild, and had invited a representative to one of its new committees.

The toast "Our Guests" was proposed by P. A. Matthews, who spoke of the various types of pipelines, and of the many problems which will confront such a body as the Guild, where industry is going in for high pressures in pipelines, and where new steels are being used.

The response was by A. C. Hartley, C.B.E., F.Inst.Pet.

The Second Annual General Meeting of the Guild was held at Caxton Hall, London, on the 14 April.

C. C. Bates, speaking on behalf of the chairman, S. J. Manning, reported on the year's progress. This was said to be most encouraging as membership has increased by 36 per cent and there were also 22 corporate members. Reference was made to the high standard of lectures given during the session and to the two very successful annual dinners. Mr Bates also stated that it is the intention of the Guild to form technical discussion groups to deal with all aspects of pipelining.

The election of officers took place as follows:—

Chairman of council	...	C. C. Bates.
Deputy chairman	...	Capt J. W. Esmonde.
Honorary secretary	...	W. E. Medhurst.

J. W. Jones was also elected Honorary Life Member.

Nigerian Oil Pipeline

Construction work is expected to begin very shortly in Eastern Nigeria on a Bomu-Afam pipeline. The contract has been awarded to Taylor Woodrow (Nigeria) Ltd.

The line, which will cost approximately £300,000, will be 14 miles long and 12 inches in diameter. It will be buried throughout its length and is expected to take about ten weeks to complete. The pipeline will carry crude oil from Bomu to Afam and from there to the Port Harcourt terminal, some 20 miles south-west of Afam.

Aden Gas Pipeline Completed

The new 20-mile gas pipeline between BP's Aden refinery and the Aden Electricity Department's power station has been completed. The refinery will supply up to 15,000 tons of fuel gas a year through the new pipeline to replace fuel oil for firing the power station's boilers.

Gas will be carried at a maximum pressure of 80 psi. The 6-inch diameter pipeline is buried over the greater part of its length and has been laid by local contractors.

Ideas Win £2000 for Refinery Operations

Ideas for improved efficiency, submitted to their employers by two refinery operators at the Esso Petroleum Company's Fawley refinery, have won them cash payments of £1469 and £537 respectively.

The ideas which they submitted, under the Company's "Coin Your Ideas" scheme, will lead directly to more efficient operation of the hydroformer, one of the refinery processing plants on which they both work. The scheme is designed to encourage all employees to submit ideas for improving operations, which are rewarded in proportion to their value to the Company.

Last year, under this plan, Esso paid out sums totalling £6690 for ideas which were accepted and put into operation.

British Electrical Achievements

The year 1958 has been announced as a record year for the British electrical and allied manufacturing industry. For the third year in succession direct exports have exceeded £270 million, which compares with the 1938 figure of £25 million when Britain was the world's largest exporter of electrical goods.

The industry has exported over £2500 million worth of electrical products since the end of the war. If, however, the value of electrical equipment included in the exports of other industries is added, the average national level in recent years has exceeded £300 million. In 1958 electrical exports formed over 10 per cent of all U.K. exports of manufactured products.

The British Electrical and Allied Manufacturers' Association, 36-38 Kingsway, London, W.C.2, published in 1958, for the Brussels Exhibition, a booklet entitled *Serving the World*. This was a comprehensive story of the industry's past and present achievements and of its future potentialities. In March of this year BEAMA issued *Leading the World*, which records the prominent part played by the industry in the two international exhibitions, and describes the 1958 British Electrical Conference held in Brussels last year.

The account of the British Conference includes the reproduction of two important papers given there. These were "Communication Between Nations and Peoples," by Sir Gordon Radley, director-general of the British Post Office, and "Nuclear Energy—the Power of the Future", by Sir John Cockcroft, Member for Scientific Research, UKAEA.

New Lubricants for Supersonic Flights

Scientists of Shell Development Company, in the United States, have succeeded in producing advanced lubricants for supersonic flight by aircraft or missiles that can withstand both nuclear radiation and a wide range of temperatures.

Developed after several years of intensive research for the Air Research Development Command of the U.S. Air Force, the lubricants are made basically from benzene, a petroleum derivative, and oxygen from the air, and are called polyphenyl ethers.

The ethers also show promise as nuclear reactor coolants, hydraulic fluids, and base oils for greases.

Results of tests showed that the new lubricant could resist heat decomposition to temperatures of over 800°F—an increase of more than 200° over present lubricants. It could also withstand more than five times the amount of radiation possible for standard lubricants, and it remained stable to oxidation at temperatures of up to 600°F—another advance of more than 200°. Development quantities of the ethers are still undergoing laboratory tests at Emeryville, one of Shell's laboratories in the United States.

First Kuwait-Owned Tanker

Kuwait Oil Tanker Company, BP Tanker Company, and Gulf Oil Corporation (Propet Company Ltd) have stated that arrangements have been made whereby the latter two companies would charter the tanker *Kazima* for five years. The *Kazima*, a new vessel of 46,000 dwt belonging to the Kuwait Oil Tanker Company, is the first Kuwait-owned tanker. It will sail under the Kuwait flag and will be making its first voyage during May.

Unusual Method of Tank Construction

Novel construction methods have been adopted by a contractor building two 6250-ton bulk tanks for storage of motor spirit at BP Australia's Sydney Harbour installation, Berry's Bay.

Because of difficult access to the cliff-face where the tanks are situated, the contractor completely assembled the roof framework on the floor of each tank as soon as the walls were 12 feet high. Empty 44-gallon drums were lashed to this framework and water was then pumped into the tank. Once the framework was afloat the roof plates were laid. The contractor then had a floating platform from which to weld together the 6-feet high curved steel plates forming the walls. As each 6-feet level was completed more water was pumped into the tank and the floating roof rose to another working position.

*The Development of Nuclear Power**

By J. A. JUKES†

This subject of nuclear energy is one that is very highly charged with emotion. It has a background of atomic bombs, hydrogen bombs, and other unpleasant things such as radioactivity. It is also known to be a form of energy which is likely to be used extensively in the future and, in the longer term, as our main source of energy. It is also a mysterious thing; people do not understand it and the fact that radioactivity is associated with it makes it appear even more mysterious and possibly horrific.

In this atmosphere, a great deal has been written on atomic energy and on what may be possible. Much of this has been almost ludicrously optimistic or quite ludicrously incorrect, particularly on the question of how quickly certain developments take place and what is a practicable time-scale. For example, the UKAEA early in 1958 announced the very interesting and exciting developments concerning the device called ZETA, which went into commission recently at Harwell —the first large thermo-nuclear device in operation there. This was indeed a great scientific achievement, since it opened up a whole new field of development and showed great promise for the long-term future. But to read some of the accounts in the newspapers, one would feel that any year now one would be able to pour some seawater into one's petrol tank and drive away. As a representative of the U.K. Atomic Energy Authority, I can assure you that this is not likely to be the case!

UKAEA Functions

Before the characteristics of nuclear power are discussed I think the Atomic Energy Authority's position should be made clear. They do not determine the size of the U.K. nuclear power programme. That is for the Government or the Electricity Generating Boards to decide. The Atomic Energy Authority is essentially concerned, first, with weapons research and weapons materials; secondly, with research and development in the civil field, which involves the development of new reactor systems, new methods of using nuclear power, and all the necessary detailed technological work as well as basic scientific research; thirdly, with the provision of fuel for the Electricity Board's nuclear power stations. This last aspect is one which has arisen, not because of any fundamental policy reason, but simply because of the economics of the situation. The Atomic Energy Authority is already making a lot of fuel for the military plants, and it is a relatively easy matter to extend those facilities to provide fuel for civil stations. Also, as will be described later, a great deal of development work still has to be done on the fuel for nuclear power stations.

Economics of Nuclear Power

The main characteristics of nuclear energy may be divided into four, from the point of view of the economics of nuclear power stations. First of all, nuclear energy is only another way of producing heat, and one has to use it to produce useful mechanical work, through the normal heat cycle. The great advantage it has over chemical forms of production of heat is the extraordinarily large amount of heat obtainable per ton of material, the factor being greater by something like a million compared with chemical reactions.

The second characteristic is the question of size. In order that a nuclear reactor will work, it must be of a certain minimum size. The chain reaction does not take place unless it is somewhat greater than this minimum size. In addition the reactor must have around it a very thick shield to protect both people and other apparatus from the dangers of radiation emitted from the reactor. This shielding has to be there irrespective of the size or the output of the reactor. Certain instruments are also needed which again are more or less independent of the size of the reactor.

From these considerations, it will be seen that any useful power reactor has to be large, when the shielding around it is included, and it is thus quite a considerable weight. This, therefore, eliminates at once a very large number of possible uses. One may also say that these considerations of minimum size and minimum weight lead to a situation where the economies of scale of nuclear energy are really great—that the amount of increased output obtainable from a comparatively small increase in cost in the installation, is high. The change of cost as the size is brought down is very marked. This is very much more marked than is the case with conventional types of power production and this, of course, favours the use of very large nuclear power plants.

The third characteristic is the relationship between capital costs and fuel costs. In conventional stations perhaps two-thirds of total generating costs are fuel costs, and one-third are capital costs. With nuclear power the relationship is the other way round, which can be explained as follows: most of the parts of a conventional station have to be present in any case—the turbo-alternators, the boilers, etc. In addition, instead of a comparatively simple furnace, there is this complicated nuclear reactor with all its instrumentation, shielding, etc. This means that, compared with a conventional generating station, there is an additional capital cost, which, in the type of station we are building at the moment, amounts to about the same as the total capital cost of a conventional coal-fired or oil-fired station.

As against this capital cost, one has the advantage of a potentially low fuel cost because of the very large amount of heat obtainable from a ton of uranium. But these fuel costs, it should be emphasized, are very complicated, and it would not be right to imply that fuel costs are necessarily low, because in some types of reactor—for example, probably the type of reactor used in the American submarine *Nautilus*—the fuel costs are very high. And it is quite easy to run up quite big fuel bills by going for exotic types of fuel. The costs are also complicated by considerations of how the fuel is changed, how long it will last, what is done with the plutonium that is produced in the fuel, and other factors. Nevertheless, taking all these things into account, most forms of reactor are potentially capable of having very low fuel costs.

*Read before the IP Economics and Operations Group on 13 March 1958.

†United Kingdom Atomic Energy Authority.

The fourth characteristic is that we are concerned with an extremely rapidly developing technology, and this, I think, has many effects on the manner in which new problems and new developments are tackled in the industry. There are a very large number of possible types of reactor. Most of these are technically feasible and there is no doubt that, if one puts enough development effort into them, one would be able to produce something that would work. In addition, some of these have military applications, like the submarine reactor, where cost is no object. The cost of running a submarine and keeping it at sea is anyway so high compared with any conceivable fuel cost that one is not interested in the cost per kilowatt hour but in the submarine's operational usefulness. The number of reactor systems which are likely to be economically feasible is really quite small. This is reinforced by the fact that any one system will require a great deal of research and development work to bring it into a stage where it is fully capable of being operated on a commercial basis. If one attempts to develop six or seven types of reactor, for example, the amount of manpower that would have to go into the successful development is so great that it obviously would not be worth doing. We are, therefore, concentrating on a relatively small front in order that the most development possible is obtained from the particular reactor systems which are being tackled.

Reactor Types

Today there are only two types of reactor which are commercially practicable. The first of these is the Calder Hall type, a gas-cooled graphite moderated reactor. The second is the pressurized water reactor and its variant the boiling water reactor, which are the American types. They are rather smaller devices but nevertheless have fairly high capital costs. They also have rather different fuel characteristics, because they have to use slightly enriched uranium.

These types are capable of use in various forms and are capable of further development. In addition, there are other varieties which the UKAEA and the Americans are studying, but none of them are as yet on anything like a competitive basis. On the other hand, these types that have been mentioned are at the stage where it is possible to say what the cost of electricity from them is likely to be and that, in certain circumstances, it is likely to be somewhere in the same region as that of conventional types of power. All these reactor systems—those which are commercially practicable and those under development or feasible—have much the same characteristics, in the sense that they have big economies of scale, have high capital costs, and should have low fuel costs if they are developed successfully.

Within this cost structure, however, there is some scope for variations between capital and fuel costs. One can, for instance, make some variation between obtaining lower capital costs at the expense of increasing fuel costs and vice versa. There is a complicated problem here of achieving the optimum solution, which will, of course, depend upon the circumstances in which the reactors are to be used.

This general cost structure implies that the first nuclear power stations which are likely to be competitive on a commercial basis will be large base load stations, which can be run continuously night and day, so that their capital cost can be spread over the maximum number of units of output. These large base load stations can only be fitted into the electricity distribution system of the advanced industrial countries. Furthermore, in the initial stages of the development of nuclear energy it is inevitable that nuclear power will be competitive first in countries where the conventional fuel costs are high. For this reason one will find that the most favourable places for the use of nuclear energy are in Britain, Western Europe, and possibly Japan. The possibilities in the United States are very much less, because conventional fuels there are, in general, very much cheaper than in Britain. The immediate possibilities of use in under-developed countries or in other parts of the world are very slight because their size of the demand for electricity is not generally sufficient to support a large station, let alone a large station running continuously on base load.

With this background, how soon will it come about that we shall see a large use of nuclear energy in the advanced industrial countries? It should be stressed that there is inevitably a very long period between the gleam in the scientist's eye, which represents the basic idea of a reactor system, and the fully-developed commercial station. This period is something like 10 or 15 years at least. We have already passed through a lot of that period in commercially feasible systems, and are at the stage of building the first commercial type stations. But given these commercial type stations, each costing £20–£30 million or more, the time of construction is perhaps four years; the design work that has to go into them is another year or more before that. One has a generation time of a number of years, between successive types of station, which can only be reduced by overlapping the different successive types of station.

This, of course, has been done already, and the Calder Hall reactors which were built by the Atomic Energy Authority, were not commissioned when the design for the Central Electricity Authority stations was well under way. In fact, the tenders were being submitted about the time Calder Hall was brought into operation. This type of overlapping will inevitably go on in the future and, if one is to make the best use of a rapidly-developing technology of this sort, a certain degree of risk must be taken—make an act of faith and design stations on data which has not been fully proved. This means that one has to have sufficient research and development work to back up the construction work and to ensure that any problems which arise during the construction of the stations can be fully solved before they are brought into operation.

The size of the development effort does mean that the number of systems which can be adopted are limited. In the U.K. the Calder Hall reactor has been operating now for over two-and-a-half years, and a lot of work is still being done on it. We are still improving the functioning of the reactors and the fuel elements. At the same time a great deal of work is being done in support of the design and construction of the power stations being built for the Electricity Boards. All this consumes a great deal of effort, and it means that there is not sufficient effort available to develop these other exotic systems, which you see written about in the press from time to time and which sound attractive when one looks at them without really examining them in proper technical detail.

This business of leap-frogging and basing one's construction plans on an act of faith may seem somewhat hazardous, but in a subject of this sort it is really not as bad as it seems. In the case of Calder Hall the design was approved and the construction started on a fixed time-schedule, and the construction was completed on time and within the budgeted cost. The estimated cost, allowing for some contingencies, was £16¼ million and the actual cost incurred was within this figure. If it has been done on the

first station, there is no reason why it should not be done on later versions of a similar type. In fact, the tenders which are submitted to the Central Electricity Authority are fixed price tenders, although they are subject to normal escalation clauses for wages, etc. This means that the capital costs of the early nuclear power stations are reasonably well known.

There may, of course, be teething troubles which may take some small expenditure to overcome. But against this, there is always the possibility that the output can be improved by modifications in the design, or simply by improving the operating characteristics. For example, the Calder Hall reactors are now operating at 10 per cent above their design output. So the uncertainties need not all lie in one direction and one would therefore hope to obtain some gains as well as finding some unexpected difficulties.

Fuel Costs

Fuel costs, however, are likely to be rather less certain in the capital costs. This is partly because the time-scale of the development of satisfactory fuel for a nuclear reactor is a very long one, and is a continuing process. All the time a reactor is being designed and built, improvements are being made to the design of the fuel elements. And once a certain number of fuel elements have been made, design improvements will be thought of. Furthermore, it is not possible to test fuel elements under their operating conditions, except by leaving them in a test reactor or an operating reactor for a very long period. This is because the fuel elements themselves are expected to last three, four, or more years, and if they are to be tested under operating conditions, it has to be over a similar period. Therefore in a rapidly-developing technology of this sort it is quite impossible to carry out final tests on the production model fuel elements before they are put into the reactor. Uncertainties will therefore be met because of this and the best estimate possible has to be made of what the performance of the fuel element will be on detailed experimental work. A great deal of this work is being done. It is being done on complete fuel elements, on small samples, on tests on strength of materials under irradiation, and so on. Given this type of development work, there should be a prospect of achieving good performance from the first fuel elements, and further improvement as time goes on. If performance of the first charge did not come up to what was expected, it would certainly be hoped that it would improve over the years as experience was gained.

Nuclear Power Programme

I should now like to say a little about the nuclear power programme in the United Kingdom and how it has altered during the last few years. The original programme, as announced in the White Paper in 1955, was for 1500–2000 megawatts of installed capacity by 1965, and this was to save somewhere between 5–6 million tons of coal a year. It was emphasized frequently in the White Paper that this programme was flexible and that it would be subject to frequent alteration. Since 1955 there have been, in fact, two major alterations, the first one upwards and the second one downwards. The first alteration came about very largely because of the technical developments in this field. The original programme was based on very cautious estimates of the size of the stations and fairly cautious estimates of their capital cost per kilowatt. In practice, when the industrial consortia began to design these stations, the advantage obtained through the economies of scale appeared to be so great that it was found possible and convenient to build very much bigger stations than were originally estimated. As a result, the first four stations in the programme are going to have an installed capacity which will nearly amount to the whole of the original programme.

This situation was confirmed early in 1957, when it was announced that the nuclear power programme would be trebled, and therefore the installed capacity by 1965 would be 5000–6000 megawatts, and it was expected that this would produce electricity equivalent to 15–18 million tons of coal a year. Since then the capital cuts were made, and as nuclear power requires very heavy capital investment, it was not surprising that it was subject to some of these cuts. The programme of 5000–6000 megawatts has been "stretched"—which to my mind is very much the same thing as a cut. The 5000–6000 megawatts is now going to be achieved by 1966. This, of course, is still a very flexible programme and numerous changes should be expected as time goes on, because of changes in the sizes of the programme and in our assessment of the relative economics, and also relative costs of different sorts of station.

These changes in the short-term programme are of comparatively minor importance compared with its main feature. The main purpose of the initial stage of this programme is to build up an industry which will be capable of dealing with a big programme of nuclear power stations thereafter. The exact size of this programme will depend on the exact economics of the stations and the cost of the stations, and how this compares with other forms of fuel. But the great thing we are doing now is to establish an engineering industry capable of designing and building reactors and with a development potential in it so that full advantage can be taken of this new and rapidly-developing technology. Given all that, it is reasonable to assume that the size of saving in coal, or coal equivalent, likely to be made by the nuclear programme would be something like 15–18 million tons p.a. by 1966; by 1970 this might have been roughly doubled, and by 1975, it might well be somewhere in the region of 50–70 million tons of coal equivalent a year. But this will depend very much on the development of the whole fuel situation and on the way in which electricity demand and the demand for other types of fuel increases.

When the first White Paper was drawn up, it included estimates of the long-term demand for electricity, and in the same year there were published various forecasts for the probable long-term fuel consumption of the United Kingdom. I think the best established paper on that subject is the one produced by Dr G. H. Daniel, of the Ministry of Power. He set out in a paper given in 1955, estimates for the consumption of fuel in 1955, 1965, 1970, and 1975, and these have been used widely ever since, and are to my mind probably at present still the best figures. He assumed that the rate of increase of industrial production would be 3 per cent p.a. and he worked out how this would react on the use of fuel. His resulting figures were 250 million tons of coal or coal equivalent in 1955, rising to 300 million in 1965, something like 330 million in 1970, and 370 million in 1975.

Faced with a rising demand of this sort and with the very difficult coal situation, in the absence of nuclear power a very large part of this big increase in demand of 50 per cent or more over this period, would have to be met by oil. This, of course, would have had very difficult balance of payments implications and also certain strategic implications, which I believe to be much less important than the balance of payments implications. Moreover, this tight coal situation, plus the dependence on imported oil, meant that the

fuel situation in Britain looked like being very inflexible.

With the advent of nuclear energy, we have a changed situation. This has enabled very much more flexibility to be introduced into the U.K.'s energy situation, which is of very great importance to the longer term industrial future. Such flexibility has, of course, to be bought at a price and the immediate price in this case has been the actual high capital cost of the new nuclear power stations, together with the very considerable cost of the development work which has backed up the construction of these stations and is continuing on more advanced systems.

But I think that this flexibility, if it were to be obtained at all, would have required comparable expenditure in other directions. If one had attempted to obtain this room for manœuvre by a further expansion in the coal industry, taking account of the cost in investment at the margin, I think that the amount of capital investment required would have been at a comparable order of magnitude. The same is probably true of the oil industry. Yet the oil industry has the very great advantage, from the national point of view, that this increase of investment, or a very large part of it, is normally paid for from internal resources, whereas the electricity and the coal industries tend to borrow money for their investment and create financial problems as a result.

Given this flexibility, I believe that the extent to which oil and coal will be used in the next two decades will depend very critically on their competitive position with regard to each other, very much more so than has been the case in these fuels in the last few years.

The figures given above of the amount of coal that could be saved by nuclear energy, will depend upon how skilful the Atomic Energy Authority is in developing cheap nuclear fuels and developing better types of reactors with lower capital costs, etc. It also will depend on what the future trend is in the price of oil and how successful the National Coal Board is in keeping its prices down.

This situation of competition is also coming into the electricity supply industry to a much greater extent than has ever been so in the past in the U.K. The electricity supply industry has, in fact, always been a one-fuel industry. It has always been based on coal. In the last few years it has also been based partly on oil, which has been introduced at competitive rates. Nuclear energy is now coming in as well, resulting in a situation with greater flexibility in the siting of stations and the type of fuel. There is very much greater choice before the Electricity Boards.

The short-term energy situation in the last year has been completely reversed. But if one makes long-term forecasts, irrespective of the short-term fluctuations, one must expect certain such fluctuations up and down, and not be frightened by them. It is interesting to note that, even during this sudden surplus of coal and falling oil prices, electricity consumption has still been increasing at quite a rapid rate. I find this rather mysterious, because in the last slight recession in industrial activity in 1952, it did fall away a bit, but at the moment it is running about 10 per cent above last year.

The right type of assumption to take for our long-term planning is that we shall remain an advanced industrial country, and to do so we must expand. The rate of expansion must, at the very minimum, be something like 3 per cent a year. If something like that is not achieved Britain will fall well behind America, Russia, and many other countries.

If an expansion of that sort is to be achieved a plan has to be made to provide the fuel necessary to support it. I therefore think that the only reasonable basis for planning, whatever the short-term situation, is one based on a long-term trend of rising industrial production, and that rise must be of at least the order that Dr Daniel had assumed. By planning on this sort of assumption, we not only make possible the achievement of the expansion but also help it to come about.

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CONFERENCE ON X-RAY ANALYTICAL METHODS

A conference on X-Ray Diffraction and Spectrography will be held in conjunction with the Department of Chemistry at Imperial College of Science and Technology, London, S.W.7, on 6–10 July.

The conference will discuss and evaluate modern techniques and instrumentation for diffractometry and fluorescent analysis. An extensive range of modern equipment will be available for demonstrating the principles of these methods over a wide field of applications. Time will be made available for the consideration and study of samples submitted by members. Sample preparation and presentation, together with the use made of electronic analytical information, will be discussed in relation to the requirements of industry.

Full information concerning the conference, together with details of the registration fees, may be obtained from the Conference Secretary, at Research and Control Instruments Ltd, Instrument House, 207 Kings Cross Road, W.C.1.

SCIENCE LABORATORY TECHNICIANS

The City and Guilds of London Institute and the Institute of Science Technology have taken important steps to rationalize their examinations and qualifications for science laboratory technicians.

Hitherto, both Institutes have held examinations for science laboratory technicians, but in future there will be only one series of examinations, held by the City and Guilds of London Institute on behalf of both Institutes. The conduct of the examinations and their further evolution will be under the guidance of a joint advisory committee of both Institutes and the certificates awarded to successful candidates will bear the heading: "The City and Guilds of London Institute in conjunction with the Institute of Science Technology."

Transitional regulations have been agreed to ensure that no student at present preparing for the examinations of the Institute of Science Technology suffers because of the new scheme. The arrangements for the award of the Fellowship of the Institute of Science Technology remain as hitherto.

Around the Branches

ABADAN, BAHRAIN, ESSEX, FAWLEY, KUWAIT, LONDON, NORTHERN, SCOTTISH, SOUTH-EASTERN, SOUTH WALES, STANLOW, TRINIDAD, YORKSHIRE

Fawley Branch

At the monthly meeting of the Fawley Branch of the Institute, held at the Esso Club on 25 March, the speaker was B. G. Allen, manager of Esso's Advertising Dept, who gave a very interesting lecture on "Advertising". S. A. Berridge was in the chair.

Mr Allen introduced his subject by saying that in 1957, British business firms spent £340 million on advertising. The spending of this vast sum was essential to ensure an effective means of rapid communication which in this modern age, has become so essential to every marketing organization.

The lecturer pointed out that the public did not consist of a stable group of consumers, but was, in fact, changing at a rate of 1 per cent per annum. Therefore, advertising must be a sustained effort to reach and appeal to this ever-changing group of people.

To carry out this advertising, Mr Allen divided the media area into four channels: the Press, and outdoor, television, and sales promotion.

He gave various examples of outdoor advertising, such as the back panels of buses, and bulletin boards. In dealing with the television commercials, Mr Allen made several interesting points about the techniques used. They had a high advertising value, as unlike press advertising, where the reader's attention must be attracted by a provocative headline or the advertisement itself, the viewers had got to take what comes to them. However the message was only fleeting, was a good medium to establish brand names, but not at all suitable for a highly technical product.

The speaker went on to explain the enormous amount of thought and research which went into the creation of a television commercial and illustrated his remarks with films currently being used by Esso in this field.

Under the heading of sales promotion, came all those forms of advertising which operate at the point of sale, such as technical literature, calendars, diaries, and road maps, etc. Also in this group were included the display stands at various exhibitions of a technical or general nature. Lectures which come within the advertising programme, and the production of technical and non-technical films to support them, were included.

In conclusion, the lecturer explained that an advertising campaign was very rarely the result of "genius swathed in wet towels and drowned in black coffee". On the contrary, it was carefully planned to known requirements, having in mind a series of known factors to do a stated job to a defined policy.

After a lively discussion, the vote of thanks to the speaker was proposed by C. Scott.

Fawley Branch Lecture to School Children

The first of a series of lectures on the petroleum industry arranged by the Fawley Branch of the IP was given on 25 March 1959, at Totton Grammar School.

A number of these lectures have been presented throughout the United Kingdom during recent years. Their object is to show the keen interest of the Institute of Petroleum and the petroleum industry in our schools and to present to the school children some of the aspects of oil exploration, production, transportation, refining, and distribution of oil products.

The Institute of Petroleum representatives were welcomed by Mr Stevens, the school headmaster. S. A. Berridge, vice-chairman of the Fawley Branch, presided at the lecture, deputizing for Dr F. Mayo, chairman of the Branch, who incidentally is also chairman of the board of governors of Totton Grammar School. The lecture was presented by H. Jagger, B.Sc., a graduate of Southampton University, and now process superintendent at Fawley.

Mr Jagger traced the history of oil from prehistoric times, through the centuries, to its use in a multitude of ways today. He referred to the use of "oil bitumen" in the cradle of Moses, and also as a substitute for mortar in the walls of Babylon. Mr Jagger made use of numerous film strips to illustrate the technical points involved in the production and processing of oil. The use of animated cartoons to illustrate technical details proved a great success, and revealed a

Chairman of Branches Committee Retires

G. H. Thornley has retired from the position of chairman of the Branches Committee of the IP, a post he has held for eleven years. He is seen (above) *at the last Branches Committee meeting, with Dr D. F. Jacques, assistant refining manager, Fawley refinery, and* (left) *J. H. M. Clark and* (right) *J. C. Jewell, honorary secretary and chairman of the London Branch*

startlingly lucid technique for explaining abstruse points.

An excellent film was also shown of the desert oil installations in the Middle East and the construction of the Trans-Arabian pipeline.

The lecture proved to be a great success and the Fawley Branch are considering giving similar lectures to other grammar schools in the Southampton area.

South Eastern Branch

On the 5 March the South Eastern Branch were guests at a joint meeting with the Royal Institute of Chemistry, Kent Sub-Branch, when D. Patient of Baird and Tatlock (London) Ltd spoke to 50 members and guests on "Automation in Analysis".

A short film showed the manual effort involved in routine analytical work, such as titrations, with weight and volume measurements and recording of results. The use of automation for sampling, preparation of samples for analysis, and instrumental methods of measurement, leaves the scientist time for the research and development essential to scientific processes. Testing time is also reduced, since the automatic apparatus performs several actions at once, giving a closer control of the process. Human error is eliminated, and errors inherent in the machine can be compensated.

For accurate analyses, flow, volume, timing, and recording devices must be precise. Electromagnetically operated valves with rapid action are used in special manifolds for flow control in sampling or fluid dispensing on analysers. Automatic pipettes are used to deliver precise volumes of reagent. A glass syringe is mounted on a block with two valves controlling fluid entry and exit, the pressure of the entering liquid raising the weighted syringe piston until it reaches an adjustable stop, when it falls and discharges the fluid. For larger volumes level probes, either of capacitance-sensitive type for non-conducting liquids or contact type for electrically-conducting liquids are used, the valve being automatically closed when the liquid reaches the probe. This method can admit a number of liquids in sequence by the use of multiple probes and valves. Electrical sequence controllers co-ordinate the processes, and in case of fault can give an alarm signal and stop the operation.

Slides illustrated the use of these devices in various automatic titrators and absorptiometers. One unit measured a set quantity of sample, added precise amounts of several reagents in turn, admitted gases for mixing, registered the pH end-point by electrodes fitted to the reaction vessel, then drained the solution off. Results were recorded on graphs or in digital form; the unit was automatically washed before introduction of the next sample. In another titrator a burette was connected to the reaction vessel and the volume of titrant used was determined automatically by a photo-electric meniscus follower. An example of a complete automatic process was an analyser consisting of sampling unit, volumetric, mixing, and reaction unit, and absorptiometer unit for detection of uranium in certain effluent streams in the refining of uranium, which gives an alarm when the concentration exceeds a pre-set limit.

After question time, a vote of thanks to the speaker was moved by J. R. Moore and the Principal of the Medway College of Technology was thanked for use of the College facilities.

Stanlow Branch

A joint meeting of the Stanlow Branch with the North Western Branch of the Institute of Fuel was held on 19 February, at Blossoms Hotel, Chester.

In the absence of C. N. Thompson, the chairman of the Stanlow Branch, the speaker, S. S. Whitehead of Shell-Mex and B.P. Ltd, was introduced by the hon treasurer, F. P. Taylor. The subject of the talk was "Liquid Fuels and Appliances for Domestic Heating".

The lecturer began by outlining the domestic heating position in Canada, and then in the U.K. The various installations in use were the following boilers: of 20,000 Btu, domestic hot water and one radiator; of 25–35,000 Btu, domestic hot water and three radiators; of 35–80,000 Btu, on forced draught system, giving unlimited hot water and dealing with four to six radiators; and of 70,000 Btu, fully automatic, with unlimited hot water, and any number of radiators.

From various generalizations the speaker went on to discuss the type of fuel and burner available. These were, first, the vaporizing type, which was of two classes —the wick and sleeve type using kerosine as fuel and the pot type which also used kerosine—and secondly, the pressure jet burners using distillate grade fuel oils.

Great stress was laid by the lecturer on the combustion head used on the pressure jet system, which had to be of precision manufacture so as to give high combustion efficiency and long-term reliability.

The talk was concluded by mention of flue installation and the necessity of draught to ensure good combustion and compliance with the Clean Air Act.

The discussion was opened by H. L. Trafford of the Institute of Fuel, and was continued in a most lively manner until 9.15 p.m.

Essex Branch

A meeting of the Essex Branch was held on 23 March, at the Railway Hotel, Pitsea, when the subject of "Corrosion Experienced in Tankers" was dealt with by E. V. Mathias and K. Fleming, both of Shell Tankers Ltd.

The subject was split into two main divisions. In the first, the magnitude of the problem was indicated and figures presented showing that corrosion could consume vast quantities of steel and that the repair work might also necessitate the use of a great deal more. Drawings showing the structure of a tanker and the very considerable areas exposed to oil or water indicated that no simple solution could be found.

In the second part of the paper the methods of combating this wastage of steel in cargo tanks and ballast tanks were indicated. Some effective colour slides

demonstrated how modern paints, properly applied, can sometimes achieve striking results.

The main impression made on the audience was the magnitude and complexity of the problem, and question time reinforced this impression. So many of the obvious defences against corrosion, such as protective films, cathodic protection, or addition of dopes to the water did not provide anything like a complete answer to the problem, and in certain cases might aggravate the trouble.

The meeting concluded after a vote of thanks had expressed the audience's appreciation of the combined effort of the two lecturers.

Gasoline and Gasoline Engines

The last meeting of the 1958–59 session of the Essex Branch was held at the Railway Hotel, Pitsea, on the 15 April, when C. L. Goodacre, M.S.A.E., A.R.Ae.S., A.F.Inst.Pet., of Associated Ethyl Company, addressed members on "Gasoline and Gasoline Engines".

Mr Goodacre surveyed the problems associated with the development of automobile engines over a wide field of interest, covering certain aspects of fuel requirement, metallurgical problems, and general engineering difficulties. The lecture was profusely illustrated with slides.

Starting with some general considerations of fuel requirements both in the U.K. and in the U.S., the magnitude of expansion possible in the automobile industry was indicated by diagrams which emphasized the contrast between the number of cars to a family in the more highly developed countries and the hundreds of people per car in the less-developed areas of the world.

Mr Goodacre then turned to the subject of the automobile engine itself and illustrated some early designs of engine, such as the Talbot, which were suitable for high compression ratios at a time when suitable fuels were not readily available. A series of drawings then illustrated the development of high compression engines up to modern American, British, and German practice. This led to consideration of the car of the future. The contrast between designing an engine for operation chiefly at full throttle as in a racing car, and the car for the ordinary motorist who normally operates at fractional throttle openings, was stressed, also the associated aspect of the hand-built racing car engine and the production model engine which demands careful consideration of the economics of manufacturing, in addition to all the other designers' perplexities.

After this glimpse into the future, the talk dwelt on refinery expansion for the next two decades and some of the consequences this would have on standards of living.

The discussion covered a wide range of topics, including the possibilities of fuel injection which has excited some interest in recent years with the increasing use of high-compression ratios.

A very hearty vote of thanks was accorded to the lecturer, who had covered so much ground in such an admirable fashion.

Books and Films

Esso in 1958

The *Annual Review* 1958 of the Esso Petroleum Company Ltd is again, like its predecessors, particularly noteworthy for its clarity of presentation, especially so far as the financial review is concerned.

In 1958 the Company's total trading receipts, at £242,111,000, were £13·5 million up on the previous year. On the other hand, the net profit was £2·5 million less, whilst the fact that over a quarter of the total trading receipts —more than £76 million—was used to pay the Government for customs duties alone, gives one food for thought.

During the year under review Esso refined, transported, and sold millions more gallons than in any previous year. Its capital expenditure was greater than ever before. Yet the Company's earnings decreased in the year, mainly due to a fall in selling prices.

Nevertheless many important events occurred in the Esso year of 1958; a start was made on the construction of the new refinery at Milford Haven; the throughput at Fawley refinery exceeded 10 million tons for the first time; and new £10 million plant for chemical feedstocks were completed at Fawley and first supplies of butadiene and ethylene passed to customers.

In addition to telling the story of the Company's financial results and operational achievements, the report focuses on the "day-to-day" achievements, the administration work, market research, training and education, transportation, and by no means least, the product research which was highlighted in 1958 by the official opening of the Abingdon laboratories.

OEEC Tenth Annual Economic Review

In the past six years Western Europe has passed through its first relatively normal business cycle; a phase of healthy expansion was followed by an inflationary boom, and then by a mild recession. Governments made major changes in economic policy, seeking to reconcile economic expansion and full employment with greater price stability and a healthy balance of external payments. But these policies have met with only limited success.

In the recent publication, *Policies for Sound Economic Growth*, the OEEC's tenth annual economic review, the character of the post-war business cycle is analysed, and a number of lessons for economic policy are drawn from the experience of these years. The growth of inflationary forces in the Western European boom of 1953–57 is described, and the reasons for the limited effectiveness of policies to control them in this period are considered. The reasons underlying the ending of the boom and the recession of 1958 are set out, and the immediate prospects for the various categories of demand are summarized.

Europe's balance of payments problems are discussed and the recent remarkable improvement in the external payments and reserves position of most European countries is outlined.

A statistical annex brings together 41 separate tables essential to the study of this period and presents certain new and hitherto unpublished material on the revenue and expenditure accounts of governments and on the balance of international payments.

British Standards

Determination of Water by the Karl Fischer Method. Part 4.

When BS 2511, for determining water by the Karl Fischer method, was published in 1954, it was indicated that the method as given was not applicable, without modification, to the determination of water in ketones, because these react with constituents of the Fischer reagent. The addendum now published as Part 4 of the Standard gives the modifications necessary to the electrometric procedures in Parts 1 and 2 of the 1954 edition, to permit the determination of water in ketones.

The addendum may be obtained from the BSI, Sales Branch, 2 Park Street, London, W.1, price 2s. (postage extra to non-subscribers).

"Britain in the Common Market"

A new report by a working group of the Federal Union puts forward the case for Britain joining the Common Market, and shows how this would affect Commonwealth trade.

The report underlines that the events of the last few months have shown that a Free Trade Area is not possible to negotiate. The United Kingdom must either be right inside the Common Market or right outside it. Membership of the Common Market is, therefore, vital for Britain's economic and political strength.

The case for the desirability of the U.K.'s entry into the Common Market is presented clearly and compellingly. The subjects of the resultant tariff arrangements and the safeguarding of Commonwealth interests are explained in a comprehensive manner, whilst the various arguments against the U.K.'s participation are countered factually.

To sum up, the report says that if the U.K. stayed out of the Common Market, the great bulk of her imports from the Commonwealth would suffer from her economic weakness. If the U.K. participated, not only would her own strength be enhanced, but she would have Europe's whole weight behind policies for Commonwealth development and trade.

The document, *Britain in the Common Market*, is available for 2s 6d from: Federal Union, 10 Wyndham Place, London, W.1.

European Energy Statistics

The OEEC have published a new item in their series of statistical bulletins, entitled *Basic Statistics of Energy for OEEC Countries*.

The booklet gives tabular data on the production and uses of the various energy sources for the last seven years. Details are given both for the OEEC area as a whole and for each of the member countries.

The bulletin costs 7s., and is obtainable in the U.K. from HMSO.

"Wiggin Nickel Alloys"

Now available from Henry Wiggin and Co. Ltd, Thames House, Millbank, London, S.W.1., is the fiftieth issue of their well-known technical periodical *Wiggin Nickel Alloys*. This special edition has been designed by Royston Cooper and contains a number of his striking contemporary paintings, supplemented by many excellent colour photographs and other illustrations. Its theme is the scope of the Wiggin organization, its products and their properties, and the wide range of uses to which they are put throughout industry.

Bibliography of Gas-Producing Processes

The Gas Committee of the OEEC have published a collection of very detailed bibliographical references on the techniques and economic efficiency of the various processes for producing gas from the different raw materials used in OEEC member countries.

The work covers everything written in Europe since 1950 on the following subjects: distillation and gasification of solid fuels, use of liquid petroleum products and liquefied petroleum gases, use of natural gas and firedamp, use (direct or after processing) of refinery tail gases, and the treatment of gases.

Copies of this catalogue and of any of the bibliographical references it contains, are available free of charge from the Secretariat of the Gas Committee, OEEC, Chateau de la Muette, Paris, 16eme.

Industrial Control

A new 58-page booklet entitled *New Developments in Industrial Control* gives a comprehensive survey of five approaches to the subject: economic forecasting; management accounting; the electronic computer; the statistical; and the personal. Each separate aspect is described by a specialist in the subject.

The booklet is published by the Department of Management Studies, The Polytechnic, Regent Street, London, W.1. The price is 5s.

Commercial Computer Survey

Much of the existing computer information is of a highly technical nature, and not generally acceptable to management. In an attempt to remedy this problem Computer Consultants Ltd have compiled, with the aid of manufacturers, a comprehensive survey of the computer market in a form considered suitable for use by management.

This work, the *British Commercial Computer Bulletin*, consists of 180 pages giving details of the computer manufacturing companies and their products. It costs 3 guineas a copy, inclusive of one year's updating service, and is obtainable from Computer Consultants Ltd, 43 Halstead Gardens, Winchmore Hill, London, N.21.

Maps and the British Countryside

National Benzole Company Ltd have recently published Volume 6 of their popular series *Our National Heritage*.

This deals with Britain's nine national parks and the three projected Scottish national parks. The rich beauty and grandeur of these specially selected areas—representative of the finest types of British countryside—is conveyed in full by the excellent photographs.

With each picture there is a small map showing where the scene is located with a map reference from the new series of road maps produced by the Company.

These road maps have now been complemented by the "Super Planning Map", covering the whole of Britain on a scale of 16 miles to 1 inch, which enables motorists to plan their route between two points and then use the more detailed road maps on the actual journey.

All principal roads are shown, and other information includes distance tables between chief towns, gradients of steep hills, and list of ferries. All road signs, including those of the new motorways, are illustrated.

This "Super Planning Map" costs 1s., but is included at no extra cost in every complete wallet of the Company's road maps, the price of which is 7s. 6d.

Publications on Automation

An Automation Bibliography has been prepared by the Technical Division of the National Office Management Association of the U.S.A. This listing contains more than 175 references to books, booklets, magazine articles, pamphlets, and films from over 50 different sources, and is written in a concise, easy-to-read style. All items are listed alphabetically by title. It should be a boon to those companies investigating data processing systems or to interested individuals wishing to broaden their scope of knowledge in this field.

In addition, the National Office Management Association has published a 38-page *Glossary of Automation Terms* containing definitions of words and phrases commonly associated with electronic computer terminology. It was compiled to help establish a common understanding of the new language which has evolved from the concepts of automation and its many ramifications.

Both publications can be obtained from the headquarters office of the National Office Management Association at 1931 Old York Road, Willow Grove, Pa, U.S.A., for $2 each.

United Steel Companies' Review

The annual Review of Progress, for 1958, the report for the Companies' employees, has been issued by The United Steel Companies Ltd.

A deterioration in the trading conditions in the steel industry is reported, and for the first time for twenty years the Companies have been faced with considerable reductions in demand, and consequently in production. The trouble in the industry was, however, virtually world-wide, but it may well be that now the recession period is drawing to a close.

The publication reviews the effects of the recession on the companies, lists the output of the various products, and presents the financial results for the year and the current development schemes.

Protective Coverings for Cables

The Specification No. Elec. 4, *Underground Lead Covered and Armoured Cable Protected Against Corrosive Attack*, was first issued in January 1957 by the then Oil Companies' Materials Committee, now the Oil Companies' Materials Association.

It has now been revised, and is concerned only with the protective coverings applied over the lead sheath of a standard cable supplied to such national standards as BS 7, BS 480, etc. This revised issue differs from the original in that, first, textile materials have been omitted entirely, and secondly, the thickness of the PVC tapes in Specification A have in consequence been increased from 0·005 to 0·015 inch.

European Oil Statistics

Once again the French organization, the Comité Professionel du Pétrole, have issued one of their extremely comprehensive volumes of petroleum statistics. The latest publication is entitled *Energie et Marche Commun—Éléments Statistiques*. Details of production, imports, exports, consumption, etc, are given for coal, electricity, oil, and natural gas for individual countries within the OEEC area, and for the U.K. and U.S.A.

Maps included show Western European refineries, oil and gas pipelines, and petroleum production areas, in addition to sedimentary areas and districts under oil exploration licence. Copies are obtainable from the publishers at 51 Boulevard de Courcelles, Paris, 8e.

Safety Code for Radioactive Markers in Go-Devils

Safety precautions for workers who may be exposed to ionizing radiations arising from the inclusion of radioactive markers in "go-devil" devices for the detection of obstructions in pipe-lines, are set out in a new booklet, *Radioactive Markers in Go-devils; Safety Precautions*, published by the Ministry of Labour and National Service.

The use of radioactive substances requires the observance of strict precautions, and a code of practice for persons engaged in such operations is set out. This new illustrated booklet is one of a series dealing with safety, health, and welfare in industry being prepared by the Ministry of Labour and National Service, and designed to give guidance and information about the best practices to be followed.

The booklet is obtainable from HMSO, price 1s. net.

Film on Control Valves

Available from Fisher Governor Company, Airport Works, Rochester, Kent, is a 25-minute film, *Muscles of Control*, produced by the parent Company in the U.S.A. First pointing out the dependence of process industries on automatic control valves, the film then proceeds to show the importance of research as an aid to design and manufacture.

The selection of the right valve for the right job is well illustrated, and methods of overcoming the effects of erosion, cavitation, and vibration are shown. Automatic valve actuators are lucidly described and future trends are touched upon.

In full colour, the film should be of considerable value to those concerned with the flow of fluids in a line.

Petroleum Gases Aid Steel Production

Recently in London Kellogg International Corporation showed a film describing the Hyl Sponge iron process, a process developed by Hojalata y Lamina SA, of Mexico, and engineered by Kellogg. The M.W. Kellogg Company, New York, is licensing agent for the process, which is basically designed to use natural gas, but can also be adapted to use LPG, refinery gas, gasified oil, coke oven gas, etc. When using natural gas, the gas is first desulphurized and then passed through a Kellogg steam reforming furnace to produce a reducing gas of about 85 per cent hydrogen and carbon monoxide, the remainder being carbon dioxide, methane, and water vapour. Gas and iron ore then pass through the reactors in a 4-hour cycle, the resultant hot sponge iron being transported to a melting furnace.

The film covered a 200 ton/day plant operating at Monterrey for Fierro Esponja. A 500 ton/day plant is to be constructed. Estimated operating costs of a 500-ton plant based on U.S.A. figures is $9·77 per ton Fe.

Arrangements for showing the film can be made with Kellogg International Corporation, Kellogg House, Chandos Street, London, W.1.

Films Catalogue

Petroleum Films Bureau has now published their 1959 catalogue of 16 mm and 35 mm films. The new catalogue lists 250 films on a variety of subjects in addition to those on the petroleum industry, including aviation and motoring, power and engineering, agriculture and horticulture, and safety-first instruction.

Copies of the catalogue are obtainable, free of charge, from the Bureau, at 29 New Bond Street, London, W.1.

Rise in U.S. and Canadian Reserves

U.S.A.

The API and the American Gas Association have published their joint report on U.S. reserves of liquid hydrocarbons, which declares that total reserves of crude and gas liquids rose by 752·2 million brl during 1958 to a year-end estimate of 36,739,935,000 brl. This was 403 million brl higher than the previous peak, registered in 1956.

Within this total the figure for proven crude oil reserves rose once again, after its decline of a year previously, by 235,512,000 brl to 30,535,917,000 brl, the largest figure ever recorded. This includes the offshore reserves of California, Louisiana, and Texas. A notable facet of the climb in reserves for the majority of States was the drop in those of Texas for the second year in succession. Texas crude reserves fell by nearly 233 million brl to 14,322 million, and her total liquid hydrocarbons by 112·6 million brl to 17,714 million brl. In contrast, Louisiana led all states in additions to reserves, reaching 4,044 million brl of crude (186 million brl increase), and 5,240 million brl of total liquid hydrocarbons, (363 million brl increase).

U.S. proved recoverable natural gas reserves increased by over 3 per cent to total 254,142,037 mcf. Louisiana again had the largest individual gain—an increase of nearly 4 mmcf —to a total of 55,111,862 mcf. Texas gas reserves rose by 2 mcf to a figure of 115,045,743 mcf.

Canada

The Central Reserves Committee of the Canadian Petroleum Association have simultaneously issued their estimates of Canadian proven reserves.

Crude reserves rose by 291,450,000 brl to 3,165,904,000 brl at the end of 1958. Alberta's total, which registered a fall twelve months previously, increased by nearly 212 million brl.

Natural gas liquid reserves at 484,193,000 brl showed an increase of 89,533,000 brl, bringing total reserves of liquid hydrocarbons in Canada to 3,650,097,000 brl.

The total of 23,295,052 mcf of natural gas reserves announced, was an advance of 2,552,921 mcf on the previous figure.

The World

These estimated figures of U.S. and Canadian proven reserves of crude oil complete the picture of estimated world reserves reproduced on page 86 of the March 1959 issue of the *IP Review*. The estimates of the *Oil and Gas Journal* in the table are seen to be over-optimistic as far as the U.S.A. and Canada are concerned.

Amending the table on page 86 with the API and CPA official figures, the world total would therefore become 272,403,000,000 brl.

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Lectures, Conferences, and Courses

1959 Marburg Lecture

Dr Herman F. Mark, director, Polymer Research Institute of the Polytechnic Institute of Brooklyn, will present the Annual Edgar Marburg Lecture at the 62nd Annual Meeting of the ASTM, at Atlantic City, on 23 June. This annual lecture is a memorial to the first secretary of ASTM and was established to emphasize the importance of furthering the knowledge of properties and testing of engineering materials. This year's lecture is concerned with the problems posed by the discovery in the last few years of many new organic polymers.

International Scientific Film Congress

Representatives of documentary and scientific film organizations from many countries will meet at the 13th Congress of the International Scientific Film Association, to be held in London and Oxford from 23 September to 2 October.

This year it is expected that over two hundred films covering research, medicine, education, and popular science subjects will be screened during the Congress and its accompanying Festival. The award-winning films will be shown at the National Film Theatre on 2 October.

Organization of the Congress, which this year is to be residential, rests with the British Scientific Film Association, the body in this country responsible for the recording and promotion of films in the service of industry, medicine, and science. Further particulars may be obtained from the Association's office at 3 Belgrave Square, London, S.W.1.

Production Engineering

A full-time course on production engineering will commence in October at the City and Guilds College, Department of Mechanical Engineering. The course will be of one year's duration and successful candidates will be awarded the DIC.

The three compulsory subjects to be taken are industrial engineering, management and industrial administration, and statistics and statistical methods. In addition, a selection should be made from a list of optional subjects. Prospective entrants should possess a degree or equivalent, together with some practical experience.

Further details and applications for admission should be made to the Registrar, Imperial College of Science and Technology, South Kensington, London, S.W.7.

Fat Research

The International Society for Fat Research (ISF) will hold its Fourth Congress in Graz (Austria) from 1–3 September 1959. Founded in 1954, the Society's membership of about 300 includes nearly all the leaders of the fat industry. Former Congresses were held in Mailand in 1956, in Paris in 1957, and in Seville in 1958.

Details are available from the Secretary, Internationale Gesellschaft für Fettwissenschaft, Graz, (Osterreich), Schlögelgasse 9.

Increased U.K. Oil Consumption in 1958

Consumption of petroleum products in the U.K., excluding foreign bunkers, rose to 31,065,629 tons—a 25·3 per cent increase over the figure for 1957—according to the PIAC statistics just published by the Petroleum Information Bureau. This is a return to the trend of the increased demand for oil products, contrasting with the drop of 1·9 per cent registered in 1957, which was adversely effected by the Suez crisis. Nevertheless the 1958 total is also an increase of 23·2 per cent over 1956, the last previous year of "normal" consumption. Details can be seen in Table I.

With regard to individual products, the largest increase was in the use of fuel oil, which, excluding refinery usage, totalled 10,581,788 tons—a 52·7 per cent rise. Its use for central heating and steam raising increased particularly rapidly.

Deliveries of gas diesel oil, at 2,987,390 tons, were up by 27·6 per cent, and again its use in central heating increased considerably.

Motor spirit was 15·3 per cent more than in the previous year, totalling 6,623,508 tons, but only 4·7 per cent above the figure for 1956. Dealer trade topped the 5 million tons mark for the first time in any year, and contributed 76·7 per cent of total motor spirit deliveries. The use of derv fuel increased by 14·2 per cent to 2,049,465 tons.

One of the most notable features of the demand for petroleum products in 1958 was the expansion in deliveries of burning oil. Consumption of this product increased by 41·4 per cent over 1957 to reach 1,124,474 tons. Burning oil is used chiefly in portable domestic space heaters, of which there are thought to be about 8 to 9 million in use in Britain.

The trend in the decline in use of vaporizing oil continued, as more and more diesel tractors were introduced (as can be seen in Table V) the drop being 14·4 per cent compared to 1957.

TABLE I
U.K. DELIVERIES INTO INLAND CONSUMPTION OF PETROLEUM PRODUCTS
(in tons)

	1958		1957	
Aviation fuels ...		1,565,006		1,629,806
Motor spirit (incl. motor benzole)				
Dealers:				
Premier grades	3,493,049		2,811,794	
Standard grades	1,586,831		1,487,581	
Commercial consumers:				
Premier grades	360,008		274,436	
Standard grades	1,183,620		1,171,218	
		6,623,508		5,745,029
Industrial spirits (incl. industrial benzole)		181,755		170,986
White spirit ...		151,163		148,653
Kerosine:				
Burning oil ...	1,124,474		795,432	
Vaporizing oil ...	444,592		519,469	
		1,569,066		1,314,901
Derv fuel		2,049,465		1,795,154
Gas, diesel, and fuel oils:				
Gas diesel oil ...	2,987,390		2,341,362	
Fuel oil	10,581,788		6,930,713	
Refinery consumption	2,531,830		2,116,677	
		16,101,008		11,388,752
Lubricating oils and greases		871,638		826,496
Paraffin wax and scale		51,844		48,793
Propane and butane		89,125		73,011
Bitumen		867,724		848,389
Other products ...		944,327		794,598
TOTAL ...		31,065,629		24,784,568

TABLE II
UNITED KINGDOM
ESTIMATED END USE OF CERTAIN PETROLEUM PRODUCTS
(in thousand tons)

	1958	1957
Motor spirit:		
Cars and motor cycles	3,636	3,040
Taxis	30	35
Public service vehicles	95	100
Goods vehicles	2,100	1,830
Industrial use	200	200
Agricultural use (incl. agricultural vans)	225	220
Services and other Government ...	295	275
Petroleum industry own use	20	21
Miscellaneous	23	24
	6,624	5,745
Derv fuel:		
Public service vehicles	825	820
Goods vehicles	1,173	928
Petroleum industry own use	31	29
Miscellaneous	20	18
	2,049	1,795
Burning oil:		
Farming	17	18
Industrial and railways	46	48
Services and other Government ...	40	51
Domestic heating, lighting, and cooking	1,021	678
	1,124	795
Vaporizing oil:		
Agricultural tractors	415	486
Agricultural stationary engines ...	10	11
Fishing	5	7
Industrial	15	15
	445	519
Lubricating oils and greases:		
Aviation	12	12
Industrial	469	470
Marine	77	71
Motor	272	238
Tractor	42	35
	872	826

Another trend that continued was the declining demand for aviation fuels, owing to the increasingly widespread use of jet propulsion.

TABLE V
UNITED KINGDOM
INLAND END USE OF GAS OIL, DIESEL OIL, AND FUEL OIL
(in thousand tons)

	1958			1957
	Gas/diesel	*Fuel oil*	*Total*	*Total*
Burning:				
Central heating:				
Private houses	129,690	6,702	136,392	89,953
Other premises	309,309	1,459,989	1,769,298	1,207,893
Bakeries... ...	24,556	99,094	123,650	104,410
Glass	26,220	269,362	295,582	213,416
Ceramics ...	10,977	113,989	124,966	101,641
Steel manufacture:				
Open hearth ...	1,147	1,080,033	1,081,180	1,060,826
Other ...	67,938	596,459	664,397	559,332
Industrial furnaces:				
Metallurgical	49,357	303,121	352,478	340,514
Other ...	104,741	299,592	404,333	317,398
Agricultural driers and heaters ...	39,283	32,175	71,458	62,461
Steam raising:				
Public electricity generation ...	15,607	2,619,824	2,635,431	642,242
Other ...	64,653	2,658,336	2,722,989	1,938,029
Power:				
Agricultural power units ...	457,072	57	457,129	376,892
Marine craft ...	251,631	684,300	935,931	860,888
Rail traction:				
Railways ...	77,015	2,994	80,009	43,885
Industrial ...	16,505	159	16,664	18,081
Stationary oil engines:				
Public electricity supply	41,144	21,088	62,232	55,173
Other ...	339,669	3,936	343,605	284,461
Mobile diesel engines ...	358,117	17,716	375,833	312,150
Manufacture:				
Gas making ...	548,455	116,639	665,094	445,514
Other manufacturing ...	33,101	33,081	66,182	60,463
Refineries* ...	—	2,531,830	2,531,830	2,116,677
Petroleum industry	21,203	163,142	184,345	176,453
TOTAL DELIVERIES INTO CONSUMPTION	2,987,390	13,113,618	16,101,008	11,388,752

*Inc. ex own production.

End Uses

Details of end uses of certain products are set out in Tables II and V. The use of motor spirit in public service vehicles decreased slightly, but was compensated for by the increase in derv consumption by the same categories of user. Increases in the consumption of both motor spirit and derv were noteworthy in the case of goods vehicles. As was the case in 1957, compared with 1956, for details of end users of black oils, the most striking feature of this sector was the greatly increased use in the sphere of steam raising in public electricity stations—an advance of 1,993,189 tons, an increase of over 300 per cent.

TABLE III
UNITED KINGDOM
INDIGENOUS MATERIALS MADE AVAILABLE FOR DISTRIBUTION BY THE PETROLEUM INDUSTRY
(excl. SHALE AND INDIGENOUS CRUDE)
(in tons)

	1958	1957
Motor spirit (by low-temperature carbonization)	6,015	5,608
Motor and aviation spirit (by hydrogenation)	49,456	74,652
Refined benzole	306,038	324,639

TABLE IV
UNITED KINGDOM
PRODUCTION OF PETROLEUM PRODUCTS EX IMPORTED AND INDIGENOUS CRUDE AND PROCESS OILS (incl. SHALE)
(in tons)

	1958	1957
Motor and aviation spirit	6,750,648	5,908,161
Industrial spirits	1,791	1,968
White spirit	142,582	138,613
Burning oil	1,083,098	715,342
Vaporizing oil	208,923	124,210
Gas/diesel oil	6,284,658	5,066,524
Fuel oil	12,572,351	10,466,598
Refinery fuel consumption (ex own production)	2,503,445	2,090,962
Bitumen	859,526	812,825
Paraffin wax, scale, and slack wax	30,527	28,144
Lubricating oil	751,411	742,892
Propane and butane	90,711	71,895
Miscellaneous products and loss ...	1,653,567	1,650,283
TOTAL	32,933,238	27,818,417

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IP TANK THERMOMETERS

In view of difficulties experienced in Great Britain in obtaining thermometer cane suitable for use in the manufacture of thermometers conforming to IP specifications 48 to 51 C and F and 53 C and F, the following modifications have been agreed by the Sub-Committees and Panels concerned to come into force immediately:

(1) Bulb length to be increased from 10–15 mm to 10–18 mm.
(2) Scale length to be increased from 210–230 mm to 210–240 mm.

BP BEGINS MARKETING IN ITALY

Since the end of April some 1300 selling points in Northern Italy have been marketing BP products.

Until then the direct marketing of BP products in Italy had been confined to its aviation and oil bunkering services, in association with AGIP, with whom BP has been partners in the Porto Marghera refinery at Venice, since 1948. Within recent months BP has acquired the shareholding interest in the marketing organizations in Italy of two Italian oil companies. A new marketing company, BP Italiana SpA, with headquarters in Milan, has been formed.

THE ORGANIZATION OF CHEMICAL ENGINEERING RESEARCH

A publication just released reviews the work of the Association of British Chemical Manufacturers and the British Chemical Plant Manufacturers Association on a subject of great importance. *A Report of the Distillation Panel Recommending Some Basic Researches* is in certain respects unique. It is the product of a new method for the throwing-up of subjects for research through a co-operative effort by two branches of industry—chemical plant users and chemical plant manufacturers—through their trade associations.

It is almost ten years ago since the Institution of Chemical Engineers approached the Advisory Council of the DSIR with a request for the setting up of a committee to review the needs for research in chemical engineering and the extent to which they could be met by existing facilities. This request was granted, and in 1951 a committee under the chairmanship of H. W. Cremer, C.B.E., reported that existing facilities for the prosecution of research in chemical engineering, although by no means inconsiderable, were inadequate for the purpose of the chemical and allied industries as a whole.

The Committee expressed the view that national requirements as regards chemical engineering could only be met if existing facilities for research were supplemented by a central organization specially adapted or created for the purpose. One of the primary functions of a central chemical engineering research organization should be to collect and interpret information and to distribute it in a form directly usable by the practising chemical engineer.

Immediately this report was issued, the ABCM and the BCPMA considered its findings, and further consideration led to the conclusion that there was no evidence, as far as the larger firms were concerned, that absence of adequate data was holding back the advance of chemical engineering design. Furthermore, there was a strong feeling that although many smaller firms could, with advantage, make considerably more use of modern chemical engineering knowledge, the need was for guidance in applying existing information rather than for new research.

The two Associations reached the decision that they could not consider the setting-up at that time of any central form of research organization but that they should establish an advisory service which would advise member firms on request where to go for assistance with their chemical engineering problems; and to report from time to time to the Councils of both Associations on "gaps" in chemical engineering knowledge and to suggest to the Councils steps by which such "gaps" could be closed, and the means by which such work could be financed.

The Chemical Engineering Research and Advisory Service Committee of ABCM was set up and operates through a technical executive officer who is an experienced chemical engineer. The Research Committee of BCPMA which is similarly constituted, and which was already in existence, works in close co-operation with the ABCM Committee.

The university and other schools of chemical engineering, and a number of research stations in the U.K., have been visited by members of the BCPMA Research Committee, and reports of the work in progress and the facilities available have been made to members of both Associations and have been published in condensed form by the Institution of Chemical Engineers.

A major task has been to issue a questionnaire to members of both Associations in order to determine in which fields "gaps" in basic information appear to lie. The findings were that distillation seemed to be the field in which there appeared to be most demand for further work for the filling of gaps in knowledge. An expert panel was recruited from the staffs of the member firms of the two Associations and by May 1958 the present report was completed and submitted to the Councils of the two Associations.

Six research contracts, extending over a period of three years, have been negotiated with the universities of Birmingham, London (Imperial College and Battersea), Manchester, and Swansea, the cost, totalling £10,000 per annum, being met jointly by the two trade associations. The members of the Distillation Panel who produced the Report are keeping in touch with the researches which have already started at the various universities.

The universities have freedom of action and will publish their results so that all may benefit.

In addition to fostering this closer link between the universities and the two industries, the two Association Research Committees and the Distillation Panel have taken the initiative in collaborating with the Institution of Chemical Engineers in the organization of an International Symposium on Distillation, to be held in Brighton in May 1960.

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INSTITUTE OF PETROLEUM BENEVOLENT FUND

This fund, which is now managed by four trustees, is administered for the benefit of members and their dependants who have fallen upon difficult times. The income of the fund depends entirely upon voluntary subscriptions.

The Audited Income and Expenditure Account for the yeat ended 31 December 1958 shows the following financial position of the fund:

	£	s.	d.
By Balance transferred from IP Benevolent Fund ...	3,797	15	8
By Donations received during year	237	4	0
By Interest received (gross)	115	0	9
By Premiums on redemption of Bonds	1	0	0
	£4,151	0	5

	£	s.	d.
To Grants paid	120	0	0
To Investments at present market value	2,050	0	0
To Cash at Bank	1,981	0	5
	£4,151	0	5

Trade Literature, etc.

£100,000 Iran Order for U.K. Firm

Contracts worth nearly £100,000 have been awarded to Taylor Woodrow (Building Exports) Ltd, marketing members of the Arcon Group, by American contractors engaged in the development programme of the National Iranian Oil Company. A series of Arcon steel-framed prefabricated buildings is being supplied to provide administration offices, workshop stores, and pumphouses, at seven booster stations which, when completed, will double the rate of flow of the existing oil pipeline from the Abadan oil refinery to the Rey Terminal near Teheran. The main consultants for the project are A. C. Hartley, C.B.E., in association with Rendel, Palmer & Tritton, of London, and the contract is being carried out by Merritt Chapman & Scott Corporation and Associates Ltd, of New York, who placed the order for the Arcon buildings.

New Dry Film Product

Acheson Colloids Ltd are now manufacturing and marketing a new range of resin-bonded dispersions of polytetrafluoroethylene under the trade mark *Emralon*. These dispersions represent a significant advance in the technique of dry film lubrication and surface coating.

PTFE is already well known as a lubricating solid and the important advantages of *Emralon* dispersions over pure PTFE films are said to be that: they can be applied to heat sensitive surfaces, a much improved adhesion is obtained, the coatings have greater resistance to wear, and they are more resistant to corrosion. It is thus claimed to open up an extensive new range of industrial applications where the potentialities of PTFE coatings were recognized but could not be exploited, because of the need for a very high sintering temperature which rendered its application to plastics, rubber, wood, or certain metals very difficult.

Oilwell Drilling Muds

Courlose is the trade mark applied by British Celanese Ltd to their sodium carboxymethyl cellulose (SCMC), a water-soluble cellulose derivative with properties which make it particularly useful for thickening, preventing coagulation, stabilizing dispersions, sizing, and coating.

The Company has now issued a booklet on *Courlose in Oil-Well Drilling Muds* which explains its advantages over starches conventionally used in oilwell drilling. These are said to be, amongst other things, that it does not unduly increase drilling mud viscosity, is resistant to fermentation and degradation, and is relatively unaffected by the high temperatures and pressures met.

World's Largest Nylon Rope

What is believed to be the world's biggest-ever nylon rope has been made at the Leith, Edinburgh, factory of British Ropes Ltd for Shell Tankers Ltd. This 12-inch circumference *Viking* nylon rope is 720 feet long, weighs 3100 lb, has a breaking load of 126 tons, and contains 1½ million miles of nylon filament.

Le Grand Rochester

Le Grand Rochester Ltd has announced its decision to move its Rochester factory to Charlton this summer.

The Company is a member of the Stone-Platt Industries Group, and so that it may benefit fully from the available Group facilities in technique, manufacture, and distribution, it is moving to a factory on the site of its associated company, Messrs J. Stone & Co. (Charlton) Ltd. Since the Company's products are largely for export, the proximity of the new location to London Docks will be an added advantage.

Fuel Flow Test House

Further equipment has been added to the Firth Cleveland fuel flow test house, which was opened in June 1958 at the works of Simmonds Aerocessories Ltd, at Treforest. The installation comprises a De Laval 100 cc *Precision* test tube centrifuge, with ancillary equipment.

The centrifuge, which develops 10,000 *g*, will be used for measuring water content and sediment in the effluent aircraft fuels from water separators and filters. It has already proved its value in a series of tests designed to show that Simmonds Separator Conversion Kit No. N.396 converts various types of woodwool or *Hay-tank* separators for use with JP.4 fuel, in accordance with U.S. Military Specifications.

Tractor-Trailer Units for Kuwait

The tractor-trailer units in the photograph are part of a repeat order for 15 units received from the Kuwait port authorities. The vehicles are Foden FGTU 6/25 four-wheeler tractor units, complete with Gardner 6 LW engines, 5-speed super-low gearbox, twin-line pressure trailer brakes, etc.

The trailers are Dyson models, 20 and 40 feet long, and suitable for carrying all kinds of loads.

Portable Pump Set for Use with Flexible Oil Barge

A recent event of great interest was the first commercial oil delivery to be made by a towed flexible vessel. This flexible oil barge, the *Dracone*, is filled and emptied by means of the newly-developed Goodyear high-speed portable pump set carried in the small towing launch. The Goodyear A 12 Pump, driven by a Petter PC2 diesel engine, is probably the first positive-displacement rubber-to-metal type pump to operate at 3000 rev/min.

It is a product of Goodyear Pumps Ltd, 44 Brook Street, London, W.1., a member of the Holman Group, and can empty the 10,000 gallons of kerosine from the *Dracone* in 65 minutes.

New Range of Rotork Actuators

Rotork Engineering Co. Ltd, Bath, Somerset, have announced details of the new A.1 range of Rotork actuators. They comprise a series of actuators designed for the direct electrical operation of pipeline valves ranging from 4 inches at 600 psi to 12 inches at 600 psi.

The actuators are available in two forms. The first has closing torque switch only, while the second type have double torque switches with independent adjustment for each direction.

"Prospects" Number Six

The sixth issue of the Acheson "ideas" news sheet *Prospects* has been published.

Continuing the practice established in the previous issue of featuring one product, industry, or group of applications, this number is primarily concerned with the Company's *Gredag* greases.

The "domestic" subject for this issue is the Research and Development Laboratories at the Plymouth Works of Acheson Colloids Ltd.

New Oil Burners

Swinney Brothers Ltd, manufacturers of industrial and marine oil burning equipment, have reached agreement with The General Metals Corporation of the United States to manufacture in the U.K. the *Enterprise* rotary oil burner.

These new burners, to be called Swinney-Enterprise rotary burners, are of the horizontal, belt-driven rotary cup type. The range comprises twelve different sizes, covering all outputs normally required for the firing of shell type, sectional, and water tube boilers and the burners are capable of handling the heaviest grades of liquid fuel.

Swinney Brothers Ltd have also designed and produced a completely new range of oil burners suitable for industrial furnaces and boilers. The burners are of the proportioning low pressure air type and are to be called Swinney *Moduflame* burners.

New Soluble Oil Mixer

Wakefield-Dick Industrial Oils Ltd claims to have produced a unit which provides the answer to problems of the production of emulsions of water with soluble cutting oils. It is known as the 52MT Mixing Unit and consists, basically, of a 250-gallon mixing tank surmounted by a 23-gallon header tank, both tanks being fitted with graduated scales to ensure accurate measurements.

In operation, a measured quantity of soluble oil (or other desired fluid) is sprayed over the surface of the water in the mixing tank by air jets. Air also issues from pipes located near the bottom of the mixing tank and the resultant agitation of the fluids ensures complete mixing.

Dunedin System Expansion

A new system for the dynamic balancing of injectors to the fuel pump, and of accurately locating faults in the fuel system of diesel engines, has been pioneered by the Dunedin Engineering Co Ltd.

The equipment consists of a set of portable instruments designed for use while the engine is running, thus enabling correct balance of the fuel system to be obtained under true operating conditions, with the consequent advantages of increased bhp, reduced fuel consumption, lower maintenance costs, and reduction in smoke.

Details may be obtained from the Company's new offices at 73–75 Mortimer Street, London, W.1. (Tel. LANgham 3633).

Fluon Seated Leakproof Gate Valve

Joshua Hindle & Sons Ltd, Hindle House, Neville Street, Leeds 1, has published a descriptive leaflet on their new Hindle-Hamer H.15 Fluon seated leakproof gate valve.

This valve is said to provide an impenetrable shut-off upstream and downstream. It has a double-sealing action: in addition to the metal-to-metal fit of the wedge against the valve seats, two Fluon seals contained by stainless steel sleeves, which extend through the full length of the bore of the valve, are compressed against the wedge as it is lowered.

Kellogg Information Brochures

Two of the latest *Kellograms*, the information pamphlets published by The M. W. Kellogg Company, of 711 Third Avenue, New York 17, are concerned, respectively, with an *Historical Review* of the Company and with the *Application of Innovation in Engineering Systems*.

The first leaflet, published to commemorate the hundredth anniversary of the oil industry, covers the development of the Kellogg contribution to refinery and chemical plant engineering the world over. The second discusses the subject of its title with a clarity of style that is greatly helped by flow-charts and explanatory illustrations.

Radio Beacons in Oil Survey Operations

Sarah radio beacons, variants of the search and rescue and homing equipment supplied to military forces, are manufactured by Ultra Electric Ltd, Western Avenue, Acton, London, W.3. These tiny self-contained radio transmitters, provide a beacon signal on which aircraft, land vehicles, or sea vessels can "home" accurately and quickly.

The device has already proved highly successful in the Persian Gulf, where the area being worked is entirely featureless, and where due both to heat haze and dust it is normally impossible to identify any sort of position marker from the air.

Benzoic Acid PVS.

Benzoic acid PVS—purified for volumetric standardization—is now available from Hopkin & Williams Ltd, 14–17 St Cross Street, London, E.C.1. Benzoic acid has been recommended as an alkalimetric standard in volumetric analysis and has also been widely employed as a standard substance in calorimetry. For both purposes, purification by fractional freezing has been described and the efficiency of the process has been thoroughly tested.

Further information on benzoic acid PVS is included in the new edition of *PVS Reagents, Purified for Volumetric Standardization*, published by Hopkin & Williams Ltd.

Mechanized Hose Handling at Wilhelmshaven

Each berth at the new German super-tanker port at Wilhelmshaven has been equipped with a modern, fully motorized, hose-handling structure, based on an original design developed by BP and Woodfield Rochester Ltd. The Wilhelmshaven equipment has been further developed by Nord-West Oelleitung GmbH engineers, working in conjunction with the firm of Carl Spaeter of Hamburg, and the Woodfield organization. The latter has supplied from England the special booms and swivel joints, and apart from this the entire structure has been fabricated by Carl Spaeter, in Germany.

Laboratory Chemical Booklets

Two pocket-sized booklets on the subjects of *PVS Reagents Purified for Volumetric Standardization* and *Spectrosol Solvents for Absorption Spectroscopy* have been published by Hopkin & Williams Ltd, Freshwater Road, Chadwell Heath, Essex.

Electronic Bottom Hole Measuring Device

A device for the automatic control of oil production has been developed by H. Maihak AG, of Hamburg. It incorporates an alarm control and regulator that automatically measures oil production relative to bottom hole pressure.

The electronic bottom hole measuring device is sold and serviced in Great Britain and Ireland by Smail, Sons & Co. Ltd, 21–23 India Street, Glasgow. Full details and technical data may be obtained from the sales engineer at that address.

Aluminium-Faced Asbestos Cloth

Turner Brothers Asbestos Co. Ltd of Rochdale, Lancs, have announced an addition to their range of woven asbestos cloths, among which several qualities are now available having a coating of bright and highly reflective aluminium.

This innovation is of interest to industries concerned with thermal insulation problems of diverse kinds, particularly those connected with ship-building and marine refit, as well as gas turbine and aircraft manufacture. These special fabrics are also being adopted for fire-fighting and other protective clothing applications.

Pyrene Company Subsidiary

The Pyrene Company Ltd announces that it has formed a new wholly-owned subsidiary company—Pyrene-Panorama Ltd.

The new Company will take over as a going concern from Panorama Equipment Ltd, Panorama Equipment (Export) Ltd, and Industrial Protection Ltd, the business, including the trade mark *Panorama*, of manufacturing and selling safety glasses, goggles, helmets, and other safety equipment previously conducted by those Companies under the trade marks *Panorama* and *Panoramette*.

Perkins' Engine Subsidiary

F. Perkins Ltd have announced that a new subsidiary company named Perkins Engines Ltd has been formed to handle sales and servicing of Perkins vehicle, agricultural, marine, and industrial engines throughout the world.

The managing director of the new company is T. H. R. Perkins, who is also a director of F. Perkins Ltd, and other directors of the subsidiary are M. I. Pritchard, managing director of F. Perkins Ltd, and W. N. Collins, a director of the parent company.

Perkins Engines Ltd will be located at Peterscourt, Peterborough, former headquarters of F. Perkins Ltd marketing divisions, and will be entirely separated from the main production centre at the Eastfield plant.

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required by an expanding engineering contracting Company engaged on many large projects for the Oil Refinery and Petrochemical industries.

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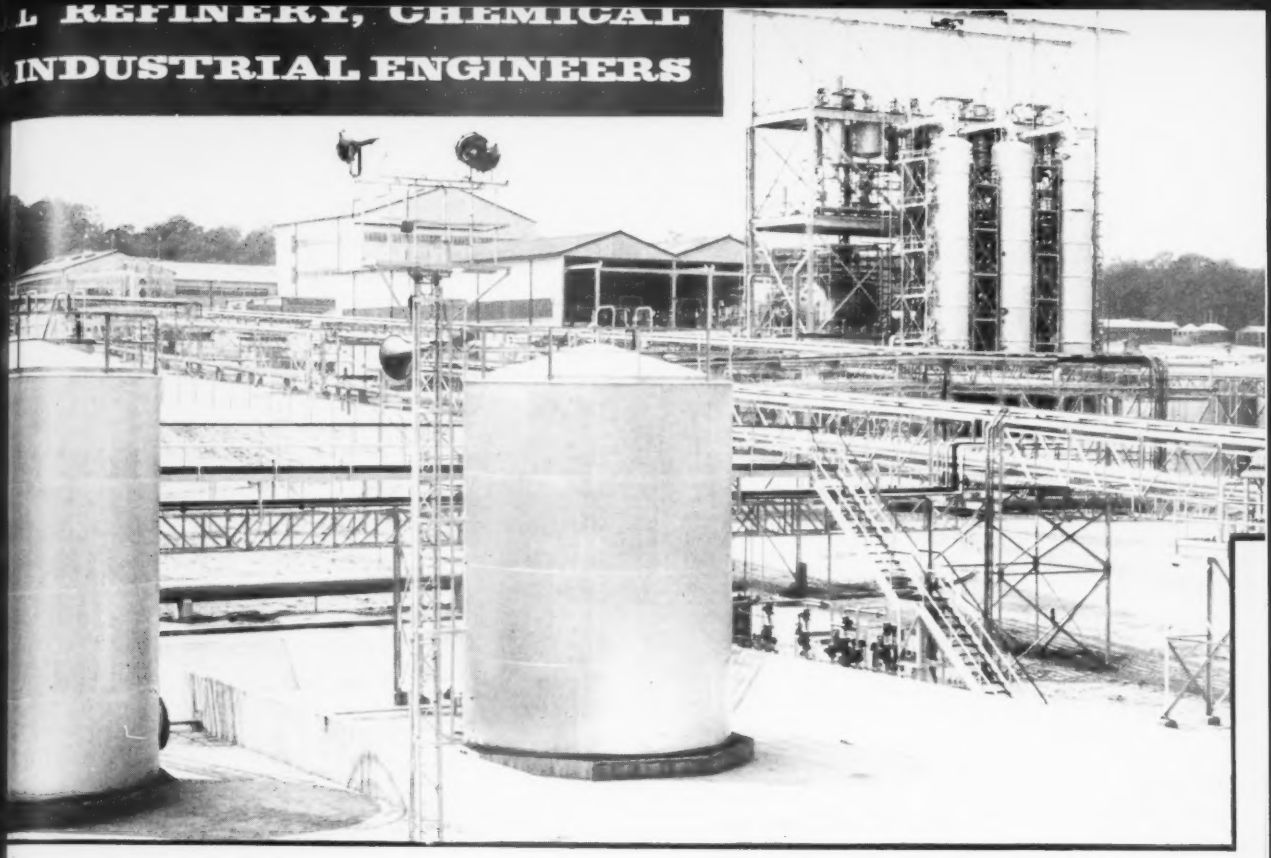

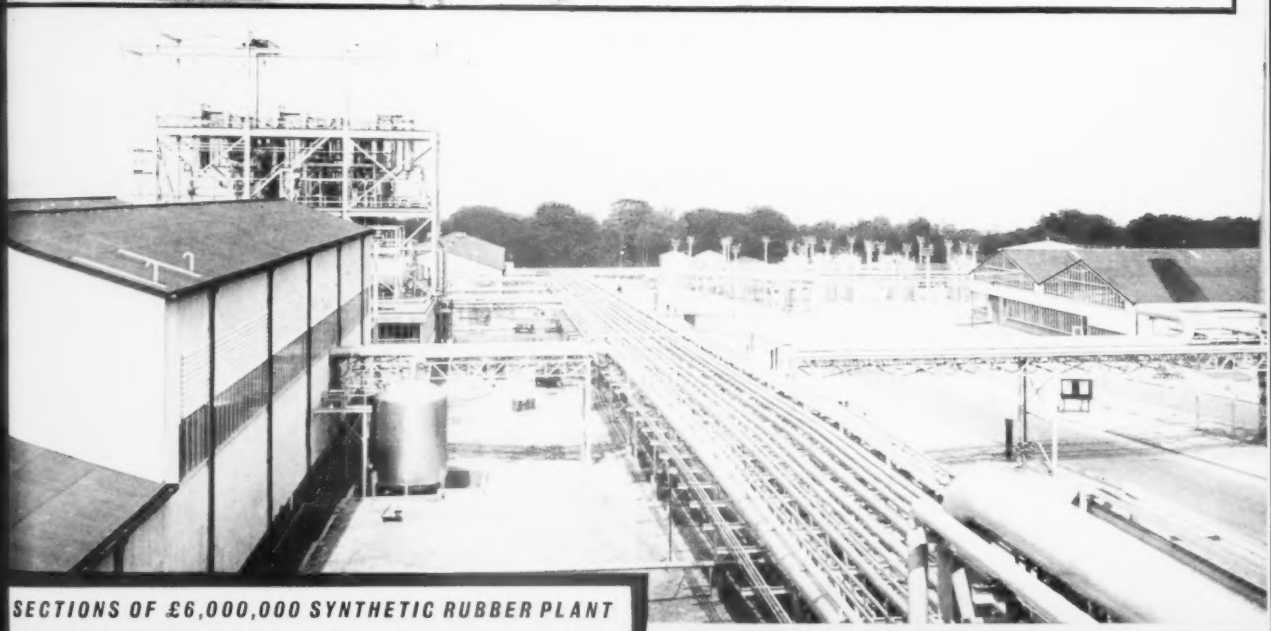

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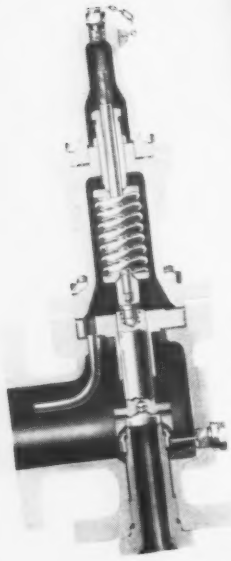

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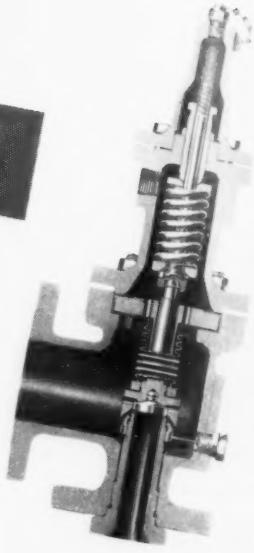

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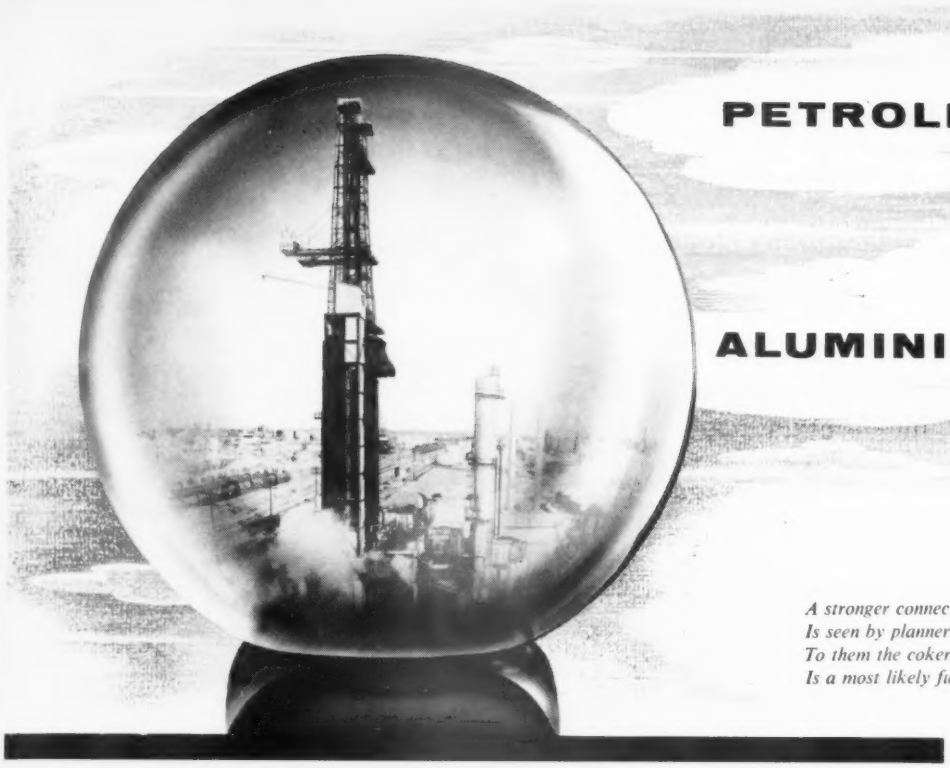

A stronger connection than the rhyme,
Is seen by planners of future time.
To them the coker, more than a vision,
Is a most likely future decision.

Looking into the future petroleum refiners can be expected to make petroleum coke for the expanding of British and European aluminium companies. To make a pound of aluminium requires half a pound of coke in the form of electrodes. Throughout the world the aluminium industry prefers to use coke made from petroleum by the delayed coking process rather than coke made from coal because of the latter's high ash content. During the last sixteen years the Kellogg organisation has on the average designed, engineered and constructed one delayed coking unit per year. The wealth of experience culminating from this continuing engineering programme to design and build better delayed coking units is available through the Kellogg International Corporation. Oil refining companies concerned with future planning are invited to discuss the economic and technical aspects of delayed coking or of any other refining process with the Kellogg International Corporation.

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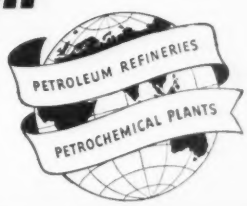
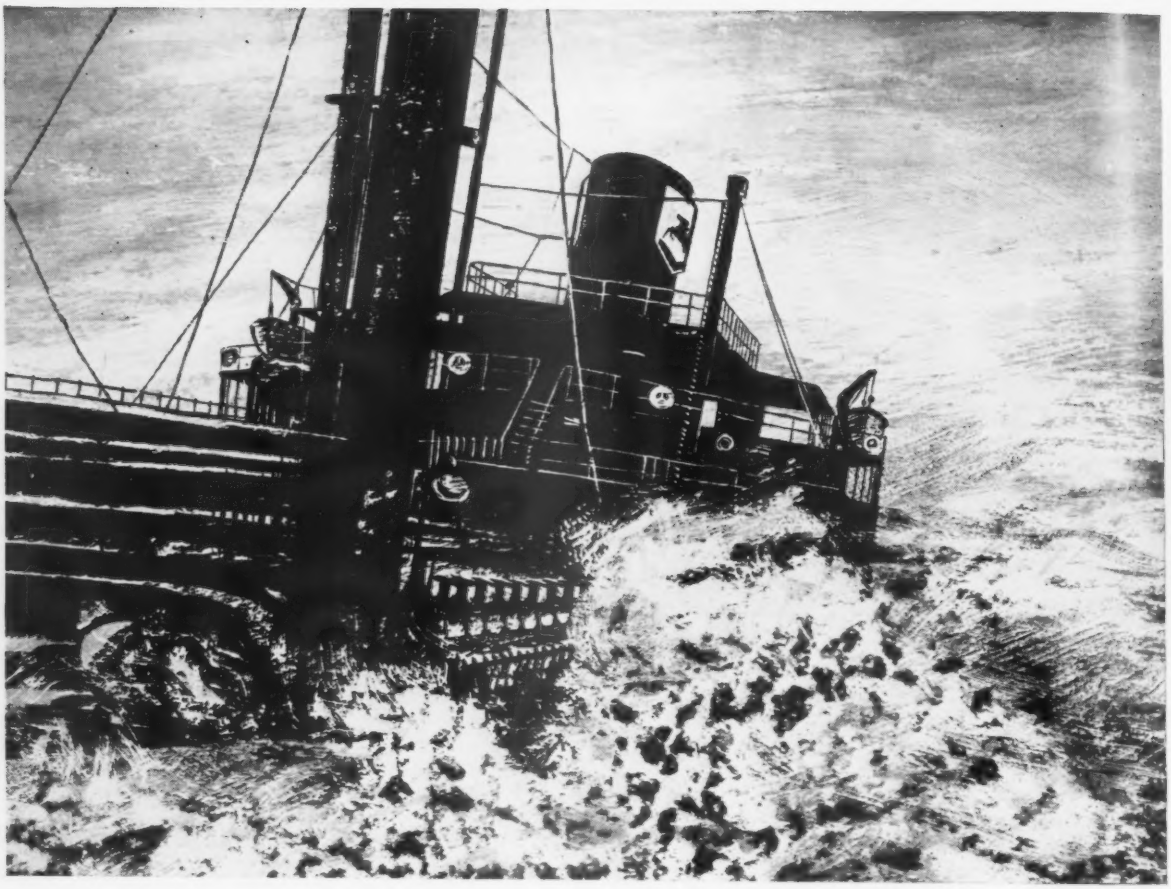
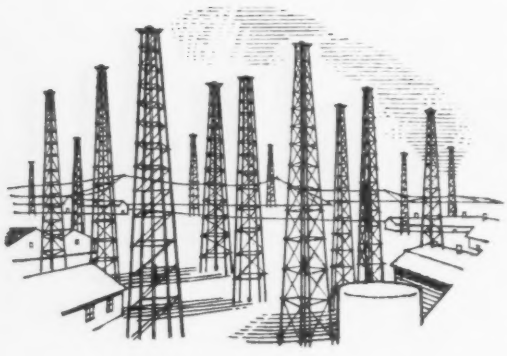




Bringing it home



TO HUMAN SOCIETY at its present stage of technical evolution, oil is one of the most valuable of all natural resources. But although oil occurs naturally in comparative abundance, its value to humanity is very much a product of human labour and skill.

The search for crude oil, sometimes far below the surface of the sea; the drilling of oil wells, and the sometimes equally formidable task of bringing them into production; the designing and building of refineries, and the transporting of crude oil to them; the organizing of product distribution to keep step with the huge and complex refinery output; these and many other strenuous activities come between the oil lying in the remote oilfield and the tankful of petrol you put in your car. They call for an expenditure of effort and skill on a scale which is unsurpassed by any industry in the world.

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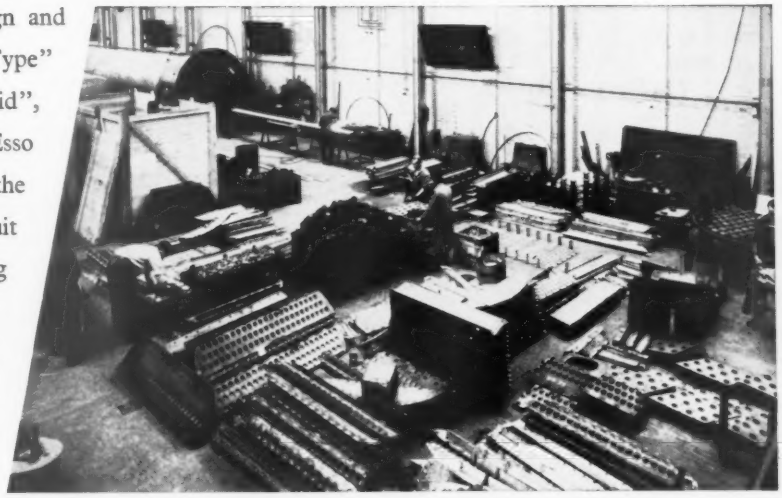

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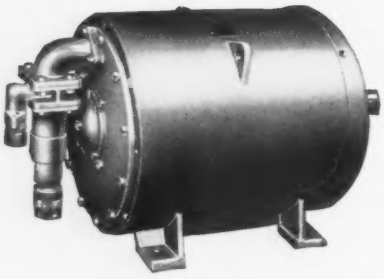

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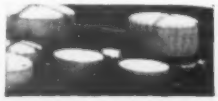

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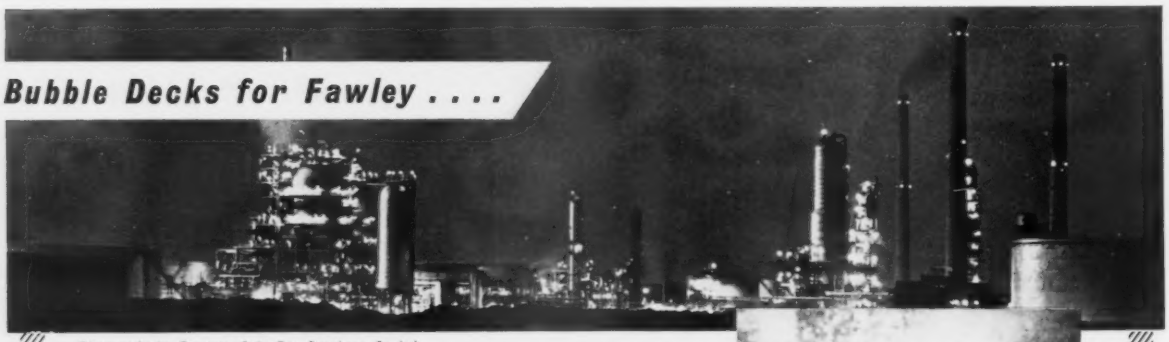
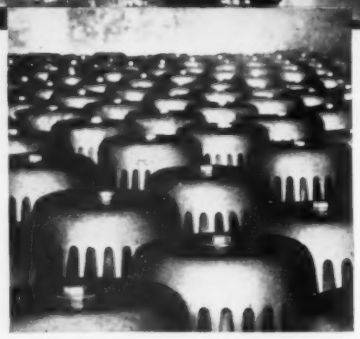


Photographs by Courtesy of the Esso Petroleum Co. Ltd.



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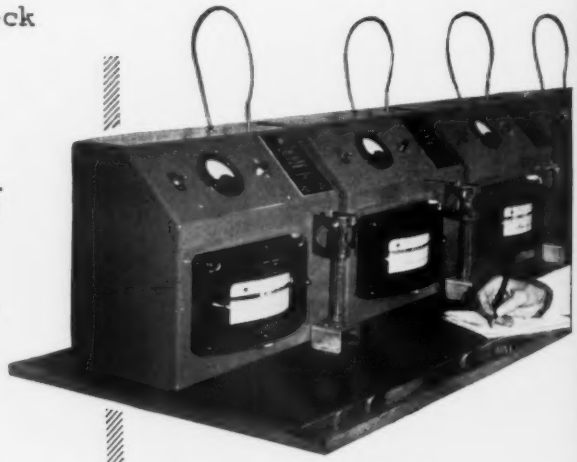

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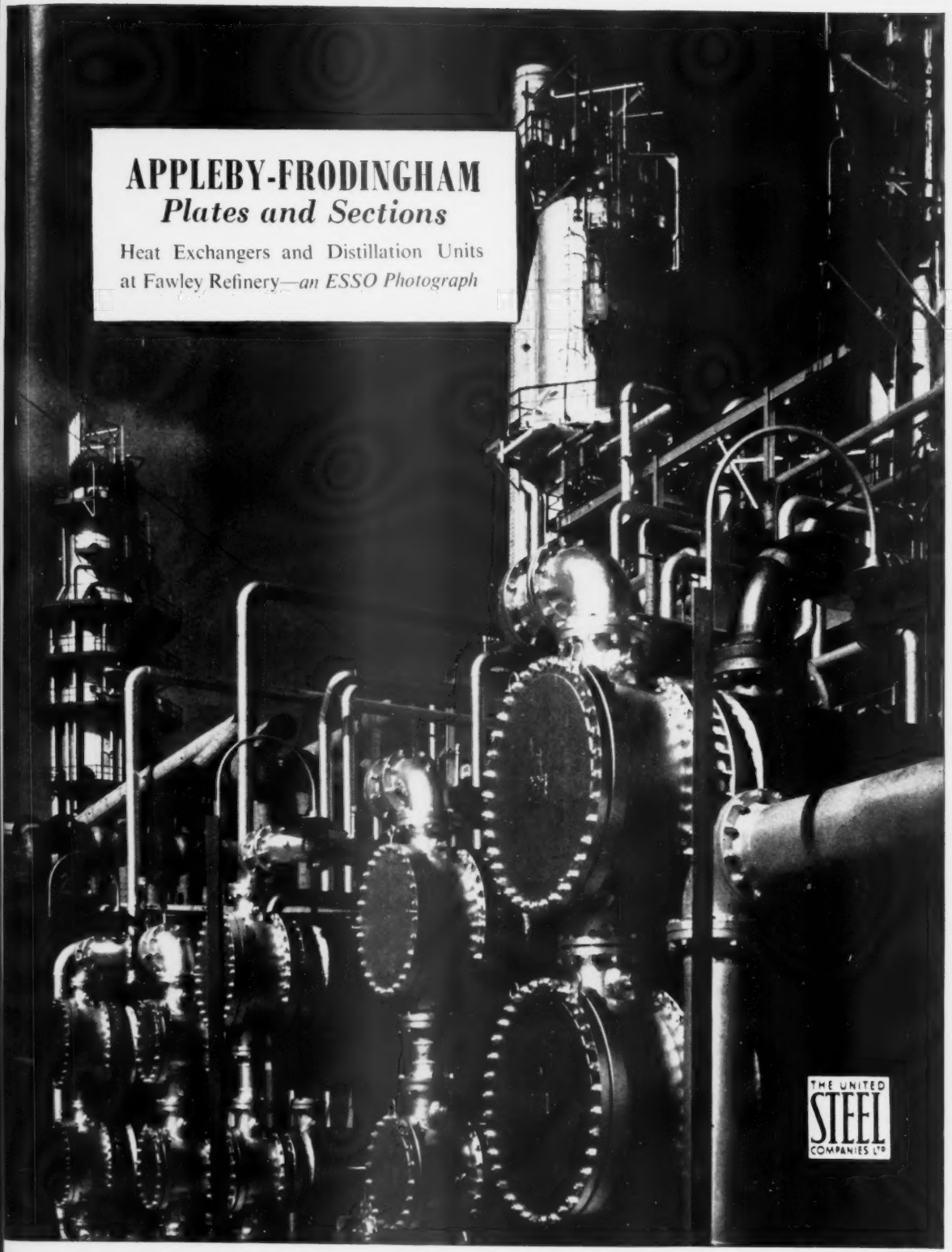

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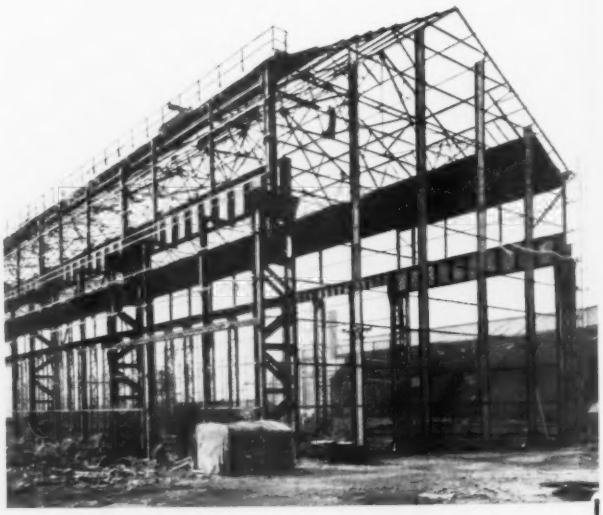

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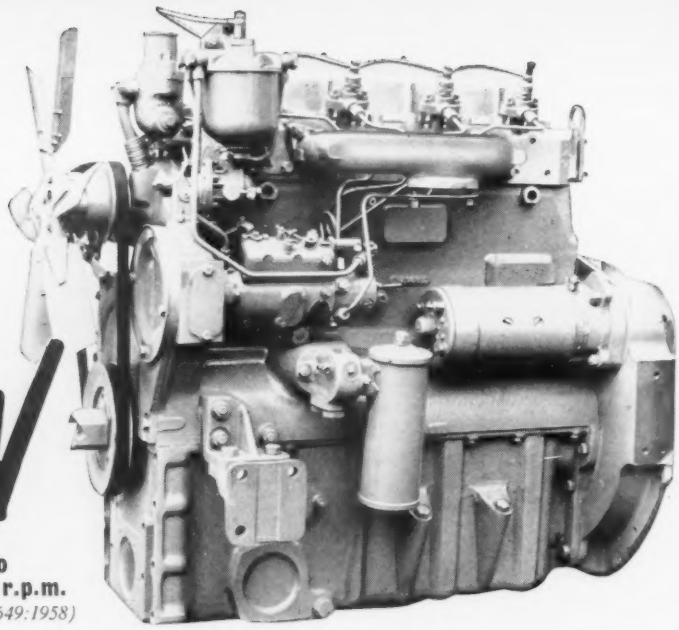

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Four 99(I)	4	3	3½	99	A	10.5	13.5	18	22	24.5	29	34	—
					B	12	15	20	24.5	27	32	38	—
					C	12	15.5	20.5	25	27	33	39	43
P3/144(I)	3	3½	5	144	A	16.5	20.5	25.5	30	33	—	—	—
					B	18.5	22.5	28	33	36	—	—	—
					C	18.5	23	29	34	37	42	—	—
P4(I)	4	3½	5	192	A	22	27	34	40	44	—	—	—
					B	24	30	37	44	48	—	—	—
					C	25	31	38	46	50	55	—	—
Four 270D(I)	4	4¼	4½	270	A	33	39	47	53	57	—	—	—
					B	36	43	52	58	62	—	—	—
P6(I)	6	3½	5	288	A	34	41	51	60	65	—	—	—
					B	37	45	56	66	72	—	—	—
					C	38	46	58	69	75	83	—	—
R6(I)	6	4	4½	340	A	38	46	58	67	69	—	—	—
					B	41	51	64	74	76	—	—	—
					C	44	54	68	81	89	102	—	—
S6(I)	6	4¼	5	450	A	49	62	80	96	105	—	—	—
					B	54	68	88	105	115	—	—	—
					C	56	70	90	108	119	—	—	—

REMARKS: A. Denotes continuous rating to BS 649: 1958 conditions (85 F. and 29.5 hg). For every 10 above 85 F. this rating should be reduced by 2% and for every 1000 ft. above 500 ft. altitude the rating should be reduced by 3½%.
B. Denotes one hour rating to BS 649: 1958 conditions. See notes above re de-rating.
C. Denotes intermittent industrial rating to 60 F. and 30 ins. hg conditions. Similar de-ratings should be made for temperature and altitude conditions.

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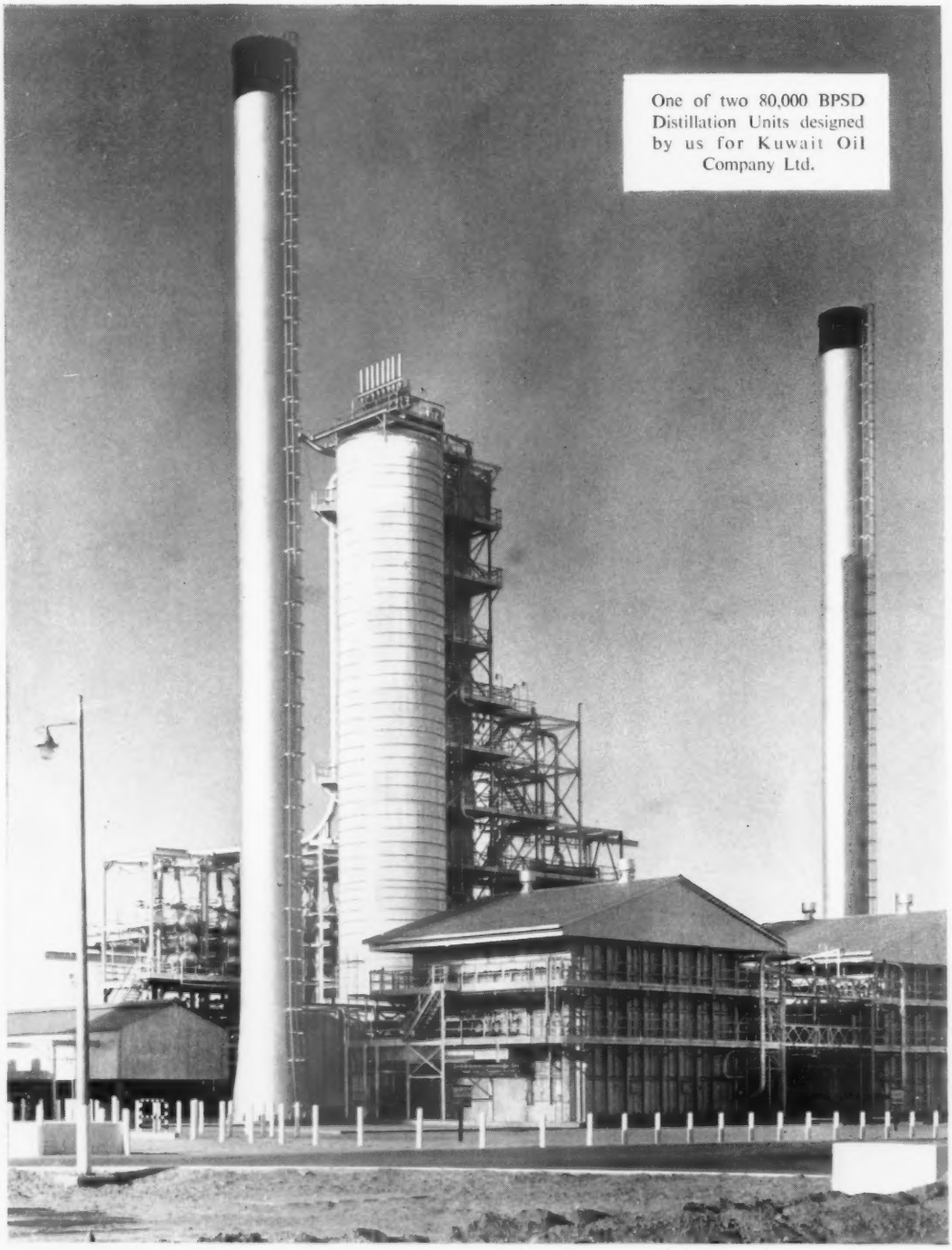

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